THE

ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

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NOW READY.

THE

UNIVERSAL ELECTRICAL DIRECTORY

(J. A. BERLY'S).

1911 EDITION

H. ALABASTER, GATEHOUSE & CO.,

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PAYMENT OF MEMBERS—ENLARGED.

WHEN the proposal to pay Members of Parliament for services rendered to the State was first mooted, thoughtful men began to wonder whither so great a change would ultimately lead. They have not had to wait long for their answer. The London County Council has upon its agenda a resolution standing in the name of Mr. Walter Reynolds, by whom it is proposed to refer the question of payment of Councillors to the General Purposes Committee. That Committee is to be asked to say: "What steps should be taken to secure for members of the Council—who discharge onerous and important public duties—and for co-opted members of Committees the payment of adequate salaries during their periods of office." It may be that this resolution is drawn up merely to set the public talking about the unwisdom of the Government proposal, and it may be, as some say, that there is little likelihood of the Council reaching the subject until after the members of Parliament are actually receiving their salaries. The question is, however, one of such great importance that we do not hesitate to touch upon it in these pages.

If the present proposals are to be seriously considered by the "Mother of Local Authorities," we shall not be surprised to find the members of every public body, from the Parish Council upwards, clamouring for emolument.

When Mr. Asquith threw the pebble payment of members into the waters of public life, one wonders if he realised how far the wave thus created would travel! In England and Wales there are over 3,000 public bodies, excluding those working under, or in co-operation with, directly elected bodies in minor matters of administration, having a membership of 51,000. In London alone there are 4,300 members of public bodies. Making all allowances for overlapping, &c., it is estimated that there are at least 38,000 individuals in England and Wales who would be entitled to salaries if the principle were universally adopted. Supposing each man to have £200 a year, a simple sum in arithmetic reveals the heavy burden which would have to be borne either by the rates or by the State.

With the political aspect of the matter this journal is in no way concerned. The proposal may be Socialistic or Communistic, but that does not concern us. The questions which we desire to consider are: What causes have operated to put so much work upon the shoulders of the local councillor that he should receive remuneration? What are the dangers to which the electrical and other industries will be exposed if payment of local councillors becomes universal?

As to the causes which have led to the overworking of our local bodies, it is manifest that municipal trading is

among the most important. When the legislature first authorised the corporations, county councils and borough councils to embark upon enterprises by which "money was to be made for the relief of the rates," these bodies were placed on a slippery slope down which they have been sliding ever since. Side by side with an access of work in this direction, there has also been an increase of other duties which has turned the councillor's life into one long series of committees. If he neglects the committees he loses his seat on the Council; if he sticks to the committee he neglects his business; and he not unnaturally asks himself: "Why should I be a philanthropist?" It may be philanthropy to supervise education or to become a member of a board of guardians; but by no stretch of the imagination can it be called philanthropic to be a member of the electric lighting committee. "Why," says the councillor, "should I do it for nothing?"

The truth in a nutshell is that Parliament, in its wisdom, has stretched the cords of local government to the breaking point. We have hinted at the true remedy; let us examine the probable effect of that which is now proposed.

What a vista of jobbery does the payment of local councillors open up! Those who devote their time to this sort of work at present are generally hard-working tradesmen; if there is a salary to be earned the man who is now leaning up against the wall of the public house will enter the arena and will often get elected. The Council will be the refuge for the destitute! We recall the case of a mayoralty which was vacant somewhere in these islands. To the office of mayor there was a handsome salary attached. One of the councillors was heavily involved. Many of his creditors were his fellow councillors. The 9th of November approached, he was elected to the civic chair, and his debts were paid off by instalments. The long arm of coincidence would have to stretch far to explain the facts on any honest basis.

That is what might go on in many places if payment of councillors out of the rates were allowed. To earn his salary the councillor would have to do something to reward those who elected him. The result would inevitably be more municipal jobs and increased rates.

The manufacturer and the shareholder in electric lighting and tramway companies has nothing to gain and everything to lose by this upward movement in the rates. The electric lighting company is a large ratepayer, but it is unrepresented on the local body. On the other hand, the vast majority of ratepayers who would cheerfully vote for the councillor "who has promised to do something for them," scarcely realise that a rise in the rates affects their own pockets. By the system of compounding, the rates are collected by the landlord as part of the rent, and are paid over to the local authority. If there is a rise in the rate, and a corresponding rise in rent, it is the wicked landlord who is blamed.

There has often been reason to suspect that some of those who at the present time take an active part in local politics are not animated by the purest motives. In our judgment, this evil would be immensely intensified by the payment of the councillors. In our view, the best way of silencing the cry for salaries would be to encourage local bodies to rid themselves of some of the duties which they now endeavour to discharge.

MINING LEGISLATION.

A certain section of the public is of the opinion that all the means of production and distribution should be in the hands of the State and controlled by State departments for the benefit of the community at large—and, no doubt, for a few in particular, the few being those at the head of the various State departments, who are now mainly holding positions which are designated by the term "labour leader." As to how the "means of production," &c., are to become State property, several methods have been proposed, all more or less drastic, but which apparently do not meet with public approval: but, nevertheless, the valiant band are in no way discouraged, and having been fortunate enough to meet with a Government willing to listen to them and to pay attention to the awful conditions under which men labour in this country, especially in our coal mines, they are apparently determined to put their best efforts forward to secure their ultimate object. To propose boldly to entrust the management of the coal mines to a State department would at least be honest, but public opinion might object, and with the objection there would probably follow the loss of office, and of emoluments which are not by any means to be despised. It is, desirable, therefore, to proceed in another way, and, as a first step, to make the general public think that mine-owners and managers are a wicked, rapacious lot, who care nothing for the lives of men employed in getting coal, and whose only consideration is the care of their property and the making of profit. So sad is the lot and so arduous the toil of these poor people, that it was necessary to pass an Act to limit their hours of labour to eight per diem, and the strange thing about it is that the very men whom a kind and beneficent Government was trying to benefit, were among the first to object to it; in the North of England they are very seriously objecting to it still. Its effect was to increase the price of production and to lower the amount of wages earned, and it has had the further effect of increasing the number of accidents. Men have now to work harder and hurry a little more in order to get through the same amount of work, so as to earn the same wages. Of course, the workman, when he supported his leaders in their demand for the Act, expected still to have the same wages, but not to have quite so much work to do for them. How could he, when he was only allowed by the law of the land to work eight hours, against nine or even longer if he wanted to, as he did before? He fails to see that the colliery owner cannot get more than a certain price for his coal, and apparently if the selling price is outside the control of the owner, the rate of pay of the miner is also outside his control. The Eight Hours Act benefited no one, and least of all the miners' representatives.

Accidents have increased, however, and evidently something is wrong, and must be put right. The manager and owner, of course, are to blame, as they have the control and direction of the mine—but have they? It is probably not generally known that the real managers of the mine are the "coal-hewer" and "putter"—not individually certainly, but collectively. Let an overman order a putter to do something he thinks he ought not to do, or does not care to do, and what happens? He tells his mates, who hold a meeting, and they all decide to leave work. Not only men, but even driver boys—a mere handful of boys of 15 and 16 years of age—will think nothing of holding a meeting, if one has some minor grievance, and decide on the spur of the moment not to

work; and the result may be that a thousand men and the machinery of a large colliery are laid idle. So much for the control and management of the mine by the manager. But what about the labour leaders? Surely they will recognise that minor difficulties and troubles ought not to be settled in this way? Theoretically they do, but practically they dare not, as the job they have is a much better one than a job down the pit; and there is now very keen competition for the position of "miners' representative."

No! it would never do to tell the men they have a duty to perform, in exercising their intelligence, in doing as much work as they can, in guarding themselves against accident as much as possible, and instead of screening and excusing an erring workman who may be foolishly and wilfully endangering his own life as well as the lives of his fellow workmen, to rebuke and report him to the proper authority, and most of all to teach him that the best way to progress is for him to produce more in order that there may be more to divide. An easier way is to get the kind and grandmotherly Government to do something, so that the "labour leader" may go to his masters and say: "Behold what I have done for you. You need not in the least care for yourselves, the manager must take care of you; if anything happens you are not in any way to blame, as the manager should see that nothing *can* happen to you. The mine owner can only work you eight hours per day, he must see that you are safe and secure from accident, he must provide you with baths in order that you may keep healthy and clean, he must provide ambulance and rescue appliances and bandages and stations at his own expense and maintain them, and so on." It is only now necessary to fix the rate of wages by Act of Parliament, and to provide food and clothing. The mine owner will then be ready and willing to hand over all the mines as a gift to the State, and will probably also beg to be given some minor position at a small salary, but with a proviso that he at last shall be relieved from his responsibility. Such is the anticipated outcome of present mining legislation.

Public Bodies and Contractors.

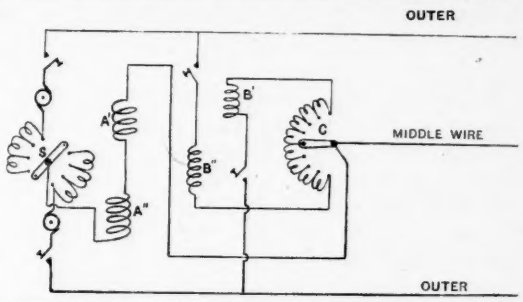
A case which was heard recently in the Chancery Division involved the decision of a point of great importance to contractors who are employed by local authorities. If damage is done to the property of third persons in the performance of such a contract, who is liable? The case in question (Robinson *v.* Beaconsfield U.D.C.) was very simple. The plaintiffs, owners of a building estate, complained that the Council had occasioned a nuisance by allowing the contents of cesspools to be deposited on their land. The Councillors excused themselves by saying:—"We employed a contractor to do this work, and are therefore not liable." The law, however, does not permit a public body thus to effect an easy escape from liability. Quoting from the judgment in an old case, Mr. Justice Joyce said:—"If the contractor performs their duty for them, it is performed by them through him, and they are not responsible for anything more. They are not responsible for his negligence in other respects, as they would be if he were their servant. Such negligence is sometimes called casual or collateral negligence. If, on the other hand, their contractor fails to do what it is their duty to do or get done, their duty is not performed, and they are responsible accordingly." As he came to the conclusion that the Council had not taken sufficient precautions for the proper disposal of the sewage, his Lordship held that it must be liable. This decision appears to accord with justice and good sense. If a local authority could absolve itself from every liability incurred in and about the performance of a contract, it might be a serious matter for the public. It is one thing to claim damages from a small contractor who employs two men and a boy; it is another to sue a body which has the ratepayers behind it. There is nothing, however, to prevent a local authority from obtaining an indemnity from the contractor; and an indemnity clause is to be found in all the common forms of contract.

THE COMPOUND-WOUND BALANCER: ITS USE AND LIMITATION.

By WALTER E. ROGERS, A.M.I.E.E

This form of balancer, which consists of two compound-wound dynamos or motors coupled together mechanically, and in series electrically, across the outers of a three-wire system, at first sight seems an ideally automatic method of keeping the P.D.'s equal between the outers and the middle wire.

Fig. 1 shows a common form of connection for such a machine. It will at once be noticed that not only are the shunt coils cross-connected, but the series coils which carry the full neutral current are also cross-connected. Provided



A', A'', Series coils; B', B'', Shunt coils; C, Rheostat; S, Starting switch.

Fig. 1.

that there are no serious faults on the outers, this arrangement operates exceedingly well. But suppose one of the outers goes dead to earth—at once the neutralcarries a current of short-circuit magnitude.

This produces such a demagnetising effect upon one of the balancing machines as to cause it to try to run away, whilst the other operates as an overloaded or short-circuited dynamo. Naturally, if the machine is not quickly disconnected from the bus-bars, serious trouble will quickly arise, unless there is an

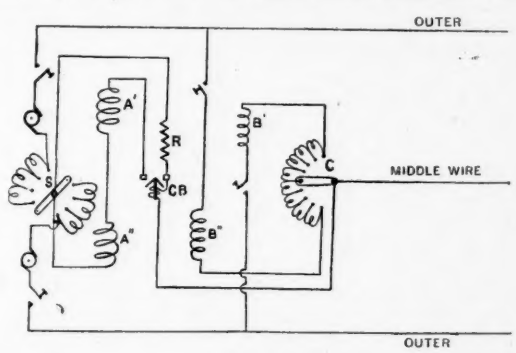


Fig. 2.

automatic means of limiting the current returning *via* the station earth plate, as, indeed, there always should be. Even when the current is limited by a resistance in the earth connection, it is advisable also to protect the balancer, by having a low resistance R always in parallel with the series coils, as in fig. 2, which shows a very simple mode of wiring the balancer. The circuit-breaker C B, of course, is set to open at any desired predetermined value. By doing this, any abnormally heavy neutral current will not cause the balancer to run away.

In specifying the above type of machine, it is well to require the ends of all windings to be brought out separately to accessible terminals mounted externally upon the machine frame. This greatly facilitates matters when experimenting with, or connecting up, one machine for milking, or any special temporary duty, &c.

Veritys' Contracts.—Messrs. Veritys' Manchester branch has just secured contracts for one 1-ton and two 2½-ton hoists from Messrs. Otto Monsted, Ltd., Godley; for several pump motors from Messrs. Beaumonts, Stockport; a repeat motor order for compressor rock drill work, from the North Lonsdale Iron and Steel Co.; an order for arc lamps, for Hunters the Teamen; and one for starting gear for the Bradford Corporation.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

British Trade in Australia.

Your advice to British electrical manufacturers in the two leading articles of your issue of January 13th, in so far as British trade in Australia is concerned, is on a par with the advice you give on the Tariff question, in that the conclusions you come to before giving the advice are entirely vitiated through your arguments being founded on false premises.

The Association to which you refer, to be formed in Sydney, had not any idea of calling upon British manufacturers to send out goods and representatives to Australia, the principal ideas being to endeavour to improve conditions for those firms that are now here, to keep the lead they at present have over American and Continental competitors, and to do everything possible to forward the interests of the members of the Association.

The Sydney Association did not eventuate, as it was considered there should be an Australian Association of British Manufacturers, and this has now been formed, with headquarters in Melbourne, and of the original members, over 10 per cent. represent British electrical manufacturing firms.

Had you studied the advertising columns of your Australian contemporary to which you refer, you could have hardly written in the strain you did, as you would have seen (I presume you consider that advertising is one good method of pushing business) that there were some 15 British electrical firms advertising through their local representatives or agents, whereas there were only four Continental firms and one American.

Your remarks are the more surprising seeing that in your issue of August 26th, 1910, you gave in detail the values of the electrical exports to Australia, those of the United Kingdom being 60 per cent. of the total, and if one of the classes, which includes a large proportion of gas appliances, is omitted, the percentage is considerably higher.

Seeing that the majority of the large British manufacturing firms are directly represented here, and a large proportion of the smaller firms have agents, and that they are all competing for what, after all, is not a very extensive trade (£817,400 for 1909), it is hardly likely that resident firms would join an association to send out a "Macedonian cry" to other British manufacturers to come and share the little business there is going.

We all trust that the trade in electrical machinery will increase, but it has to be remembered that though the country is large, the population is small and very scattered.

In your issue of January 20th, you mention one cause of orders going outside Great Britain, which is very real. There are a number of American and Continental trained engineers and managers who have the placing of orders, and they are considerably more patriotic than many of their British *confrères*; further, the Continental and American electrical firms represented here, though small in number, have, thanks to protection in their own countries, developed into such huge dividend-paying concerns that they can well afford to be particularly well represented here, and as they are so few in number, the 15 per cent. of the total trade amongst two American, and 17 per cent. amongst four Continental, is individually better than 60 per cent. amongst 30 or more British houses.

You wrote deprecatingly of the preferential treatment, fearing that "sometimes it is more nominal than real." It certainly is small when looked upon as a percentage, but if British goods had paid the same duty as non-British goods in the same respective classes in 1910, the Australian Commonwealth would have received something like £1,000,000 more revenue; further, figures show that taking all competing imports in bulk, the percentage of British goods imported has increased since the preferential duty came into force.

I believe your columns are closed to the Tariff question, but perhaps you might allow me at this distance even now to suggest one aspect of the case that was not touched in the recent controversy; Great Britain would be in a much better position to hold her own in the world's trade in electrical machinery if she had some half-dozen huge dividend-paying electrical manufacturing companies rather than the present numerous small to medium-sized non-dividend-paying concerns; such an alteration could only be brought about by a tariff sufficiently high to shut out foreign competition.

You free-traders seem to entirely forget that in free-trade England the Customs returns are higher per head than in many so-called tariff countries, but you tax the things you cannot grow or make, and let in free the things that, made or grown in England, would find work for your unemployed, and substantially improve the prospects of a large proportion of that "unhappy thirteen millions" who at present have not even enough to eat, even on prison scale, according to Mr. Rowntree's investigations.

Percy Rosling.

Melbourne, Victoria, *February 22nd*, 1911.

[There once was a time when Mr. Rosling would have adopted a different tone, but we are happy to find that he is in agreement with us on a number of points. Concerning others, it is not at all surprising that those who are doing well should not show eagerness for additions to be made to the number of competitors in the same market. The activity of Continental and American firms was impressed upon us somewhat strongly a few months ago by some well-known Australian gentlemen, who in the same breath deplored the want of enterprise of British firms. The brief Reuter dispatch which we printed as the basis of our article conveyed the same impression, though, as we said, we were unaware how far the reference related to British *electrical* manufacturers.

Mr. Rosling apparently desires our readers to understand that "the little business that is going" is already quite sufficiently looked after. He admits, however, that the foreign firms are "particularly well represented" by patriotic trained engineers and managers, which seems to convey that there is need of British improvement in that connection. Authorities from various markets have expressed themselves very strongly on the advantage that our competitors have over us in this matter, and if our firms cannot afford to do this, as Mr. Rosling says, because they are not amalgamated into "huge dividend-paying concerns," why do they not adopt the suggestion that we and others have often advanced, and co-operate with other firms in sharing the expenses of a costly and efficient foreign representation? To discuss the Tariff question at this date is against our inclinations: it was argued to the point of weariness not very long ago. When we made the remark about the preferential treatment of the Colonies being sometimes more nominal than real, we had in mind certain Australian and Canadian contracts which showed that a preferential treatment as to tariff was of little value if the predilections of the powers in authority were toward foreign manufacturers. We fear that our correspondent's desire to see half-a-dozen huge dividend-paying companies here is hardly likely to be realised, for the reasons which he himself gives. The desirability or otherwise of such a state of things may be discussed in the light of German experience when it comes within the range of probabilties. Is the writer aware that, excepting the cable-manufacturing firms, it is the bigger British works that are not paying dividends on ordinary capital? There are excellent examples among the "numerous and small to medium-sized" concerns which are able to make decent profits. As our works, large and small, succeed in increasing their business with Australasia—which we still understand to have wonderful electrical possibilities in spite of its small and very scattered population—and with other Colonial and foreign countries, so will they be able to produce a larger and more profitable and dividend-paying output without an alteration of national policy. It was reported a few months ago that an important British cable manufacturing company, not unknown to Mr. Rosling, contemplated erecting a factory in Australia. Evidently they hold

the view that the amount of business available and in prospect is increasing—small and very scattered population notwithstanding.—Eds. E.R.]

Ampere-Hour Motor-Meters of the Commutator Type.

To my great regret the proceedings of last Thursday's Institution meeting, when Messrs. Ratcliffe and Moore's paper on "Electricity Meters" was read and discussed, terminated without an opportunity having been given to any manufacturer of the above type of meter to comment on the results and opinions which the authors disclosed in their paper, and which a few of the speakers enlarged upon.

As some of the opinions expressed would, if unanswered, be likely to affect unfavourably the natural development of a type of instrument in which I thoroughly believe, I will endeavour to point out a few facts which have been overlooked by those who so freely expressed an adverse opinion on this type of meter.

It was stated that those commutator meters which had come under notice had developed serious inaccuracy, particularly at low loads after a period of service—that a characteristic trouble was that of insulation breaking down under the commutator segments, and that, in short, reliability should not be expected from this type.

It will be useful if I briefly state the commercial history of the commutator meter.

As pointed out by the authors, it is of Continental origin, and was introduced to supply the demand for a simple ampere-hour meter, not so liable to derangement as most of the existing watt-hour meters.

The mercury meter was at that time not known on the Continent, and was also very imperfect as manufactured in England.

The commutator ampere-hour meter was, therefore, designed by the leading Continental firms to be suitable for Continental climatic conditions, and to comply with the conditions of electrical standardisation and supply which obtained on the Continent.

Briefly, the following conditions had to be taken into account:—

1. Generally speaking, the climate of the Continent of Europe is of a dry nature, and porous insulating materials, such as fibre and presspahn were giving satisfactory results all round.

2. The majority of important supply systems on the Continent are run on the 100-volt basis. It was, therefore, essential that a meter should not have a higher drop in volts than ·6 to 1 volt, and, furthermore, the authorities responsible for the standardisation of meters were not prepared to allow any higher drop in voltage.

After these instruments had proved successful on the Continent, they were imported into this country, and on the strength of favourable Continental experience, it was not found difficult to effect immediate sales.

We know now that the insulating materials above mentioned are of no earthly use in this country. We also know that whilst a commutator, whether of silver or gold, will not appreciably change its surface resistance in a dry atmosphere, it will do so to a considerable extent in a moist and sulphurous atmosphere; and so it happened that these Continental meters developed serious faults. In many cases their insulation broke down after short service, and in most cases the ratio of armature circuit resistance to main shunt resistance changed as the commutator surface became covered with an infinitesimal layer of oxides, sulphides, &c.

The above considerations were taken into account when the company with which I am identified designed the E.A.C. high-torque meter about three years ago; and we realised that if the two sources of trouble above mentioned could be overcome, we should be able to produce a commutator ampere-hour meter, which would not only be a satisfactory instrument, but would offer important advantages over ampere-hour meters of the mercury type, especially for small consumers. The results have so far justified our opinions—over a hundred stations employ the E.A.C. meter; a large proportion of them have used many hundreds for several years, and let it be said that in most cases these meters were observed and tested with greater severity than would have been the case if they had belonged to another type.

By the exclusive employment of pure mica for insulation purposes, except under the commutator, insulation troubles are non-existent in our meter, although a large number of seaside towns have them in continuous use. The commutator segments are built up on a solid ebonite sleeve, and we have yet to hear of a single case of breakdown.

Happily for us the prevailing voltages in this country lie between 200-250 volts, and we were thus enabled to employ a higher and more suitable drop in volts. It will be obvious to everyone that in a shunted type of meter, in one of the circuits of which there is a point of contact which is liable to change its resistance, the percentage effect of such change of resistance on the accuracy of the instrument is inversely proportional to the drop in volts allowed at full load.

Investigations made by us and confirmed after several years' service by others, prove that the contact resistance between gold brushes and gold commutator will not alter more than ·1 to ·2 ohm under the most adverse conditions.

We have been able to construct an armature having as high a resistance as 7·5 ohms, without sacrificing that all-important factor—torque.

The maximum error which can occur in the E.A.C. meter, owing to change of resistance on the commutator surface, is therefore not likely to exceed 2½ per cent., whilst it will be obvious that under the same conditions a very much larger error will occur in meters having a correspondingly smaller drop in volts.

From the foregoing it should be observed that there is no fundamental reason why the commutator meter should not be entirely satisfactory, and if those engineers who have not had satisfactory experience with this type in the past, will take the trouble to investigate the particular merits of the E.A.C. meter, I think they will find my claims founded on fact.

The ampere-hour commutator meter has come to stay in this country. The small consumer has also come to stay, and in my opinion a suitably constructed commutator meter, having many turns in the armature circuit, will permanently displace the unipolar mercury meter for small consumers.

E. B. Schattner.

London, S.W., *March 24th*, 1911.

Alternators Driven by Gas Engines.

I have just had occasion to look into the question of the parallel running of alternators direct-coupled to gas engines. Much to my surprise, I find that the only way in which this important condition can be specified is on the general terms that they shall run "satisfactorily in parallel."

You will agree with me that this is far from technical. Could it not be more positively put by stating the temperature rise after the machines have run in parallel for so many hours at different loads, or in some way limiting the motoring current?

This is an important question, as such installations are every day becoming more common, and I, for one, would be very glad to have this point discussed in your columns.

F. W. Staines Hutchins.

Stockton-on-Tees, *March 23rd*, 1911.

Lightning Conductors.

In your issue of August 19th, 1910, Mr. Killingworth Hedges, writing in favour of iron lightning conductors, referred to copper tape as perishable.

I enclose pieces of copper band conductors I have recently had removed in the course of the installation of new systems (1) from the Houses of Parliament, Westminster, and exposed to the smoke-laden city atmosphere for over 50 years, and (2) from Althorp, the Northamptonshire mansion of Earl Spencer, and exposed for probably about the same time to the purer country air. These are both parts of systems by Sir William Snow Harris, F.R.S. The date of the first is a matter of history, for the particulars are contained in the Civil Service Estimates for 1855-6. Of the second I have no record, but it must have been installed prior to 1862, in which year Sir W. Snow Harris lost his eyesight.

D

The band conductors of those days—the precursors of copper tape, and differing only in length—were cut out of copper sheet, and though the Westminster specimen is very dirty, the marks of the shears are still visible. In the country specimen, which has acquired with age a rather attractive green tint, the edges are almost as sharp as when cut. These specimens are not specially selected, but are a fair sample of the whole.

To show how copper does perish sometimes I enclose, also (3) a piece of a copper earth-plate, originally $\frac{1}{16}$ in. thick, I removed from Gloucester Cathedral. Its condition was due to its having been bedded in coke, which, as is well known, has a very destructive effect on copper. It is not always realised that destruction may be due to a cause that could have been avoided by knowledge of its effect.

Alfred Hands.

London, E.C., *March 27th*, 1911.

[We have examined the samples sent us by Mr. Hands with great interest; the two specimens of copper strip, though slightly corroded on the surface, are practically as good as new. The earth-plate is a mere film of copper, eaten through in many places.—Eds. E.R.]

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

"A.P.W." Oil-Electric Sets.

Messrs. M. C. Shepherd & Co., of 60, Queen Victoria Street, E.C., are selling a British-made generating set for country-house lighting, &c., consisting of a paraffin engine coupled to a dynamo, as shown in fig. 1. These sets run on ordinary paraffin, which is automatically fed to the cylinder, and only one lubricator requires attention; it is claimed that the engine, in fact, is fool-proof, and

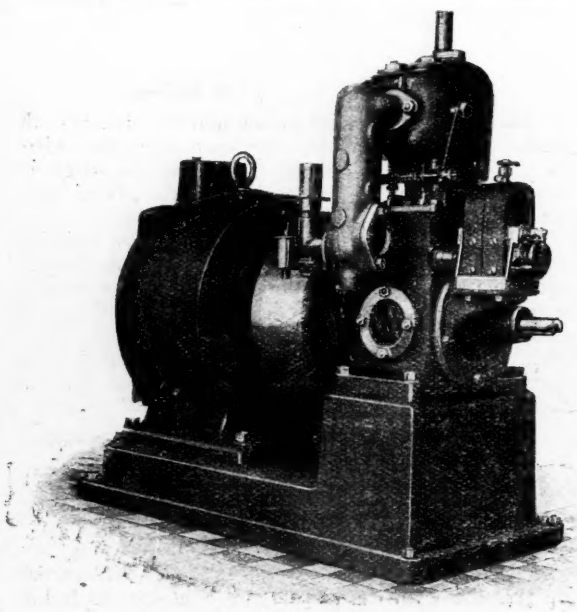


Fig. 1.—"A. P. W." Oil-Electric Set.

can be run by any intelligent workman. A small quantity of petrol is used for starting the engine. The output of the set illustrated is 30 amperes at 50 volts, or 22 amperes at 75 volts for charging a battery.

A New Lamp Lock.

We have received from Messrs. Halliwell & Co., of 43, Thomas Street, Manchester, a sample of a new patented lamp-locking device which they are placing on the market. This consists of a hinged collar with a groove running round the inner side, the free ends of which are brought together and locked by a little split pin of ingenious design, which cannot be withdrawn except by means of a special key. The collar is clasped round the lamp when placed in its holder, with the cap pins projecting into the internal grooves. The key mentioned above consists of a U-shaped piece of steel, with specially shaped ends, by means of which the locking pin can be forced out of its socket. The arrangement is designed for use in warehouses, trains, &c., where lamps are frequently lost.

Simplex Electric Iron.

The accompanying figure shows the new iron introduced by Messrs. Simplex Conduits, Ltd., of 116, Charing Cross Road, W.C., in three sizes—225 to 650 watts. The heating elements are carried on mica and inserted in holes drilled in the iron casting, so

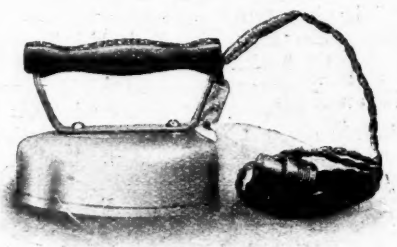


Fig. 2.—Simplex Electric Iron.

that they are entirely surrounded by the metal; the heating is rapid and efficient, and the first specimen of this type, made at the company's Birmingham works six months ago, has been on circuit continuously since October without breakdown. The irons, which are made throughout at Birmingham, are of 3 and 7-lb. weight, and heavier ones will shortly be introduced for laundry purposes.

"Albion" Combustion Meter and Recorder.

Under the above title, a simple CO_2 recorder is being introduced by the "Albion" Recorders Co., of 427, Tower Buildings, Water Street, Liverpool. A section of the instrument is given in fig. 3

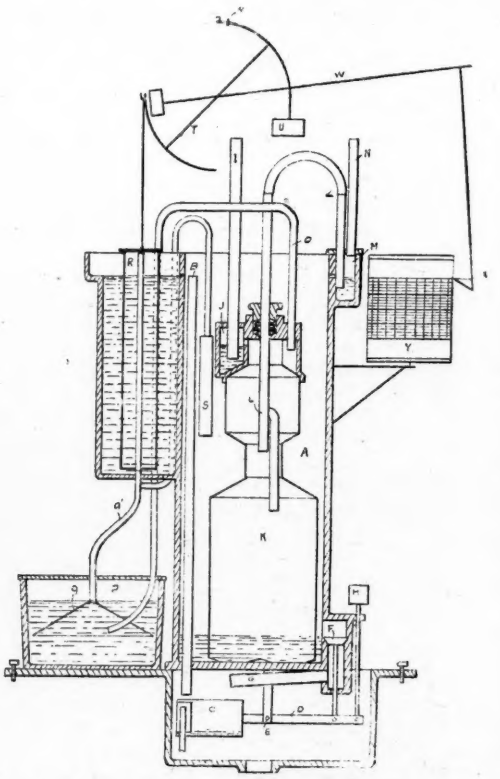


Fig. 3.—"Albion" Combustion Meter and Recorder.

Water trickles into the tank A until it overflows the open end of pipe B, and falling into pan C, carried on a lever D pivoted at E, causes valve F to lift, allowing the water in A to run out quickly. Part of the water, being directed by pipe G into the pan, keeps it full until the water in A has fallen to the level of the valve box, when the siphon in pan C empties it, and the valve is closed by the balance weight H. The filling action then recommences, and the cycle of operations is continued automatically, giving a record every 4 to 10 minutes, as desired.

During the fall of water in tank A, flue gas is drawn through pipe I, and its water seal J, and fills chamber K, and on the return of the water, part of this enclosed gas passes by pipe L through the water seal in box M, and escapes to the atmosphere through pipe N. When the water reaches the lower end of pipe L, the

remainder of the gas being entrapped is passed through the capillary tube O to the potash vessel P, bubbling through the solution, which absorbs the CO_2, and the remainder collected under cone Q passes up the connecting pipe Q' into bell R, causing it to lift. The pipe L is movable up or down, so that the quantity of gas retained in the upper part of K can be accurately adjusted.

The fall of the water in A uncovers the end of pipe S, which, being a branch from Q, allows the gas in R to escape, and the bell to fall to its normal position as shown.

The bell R is connected by a chain to the quadrant T balanced by weight U, and this revolves until 80 per cent. of the full stroke of the bell is completed, when the stop V engages with the pen lever W and depresses it, and a line is drawn by pen X on the chart Y which is carried on a clockwork-driven drum.

It is obvious that the lift of the bell will vary according to the amount of CO_2 gas absorbed by the caustic potash, and the length of the line drawn on the chart will be longer when the proportion of CO_2 is smaller, and *vice versa*. The bell is accurately balanced at all parts of its stroke, by the varying radii of the quadrant, and the gas is under constant pressure.

The water level in the bell tank, and the seals J and M, is automatically maintained by ports communicating with the main tank A. Adjusting screws on the base plate permit of quick levelling of the machine, which is contained in a strong lock-up metal case with a glass door. On disconnecting pipes L and O by means of unions provided, the whole of the inner gas vessel with its attachments can be withdrawn, and every portion of the machine is open for inspection and cleaning.

Dial Fuses.

The accompanying illustrations show the essential features of the "Dial" cartridge fuses which are being placed on the market by the Electrical Co., Ltd., of 122-4, Charing Cross Road, W.C The advantages of the cartridge type need no further demonstration; in this case, the principle of interchangeability is secured

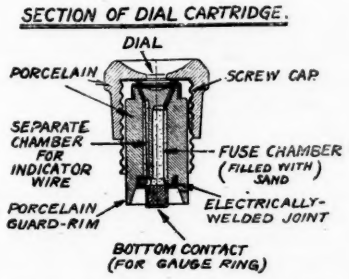


Fig. 4.—Section through Dial Fuse.

(in the "Dial A" pattern) by differences in both diameter and length, while in the "Dial B" pattern it depends upon the diameter only. The fuses blow with a continuous overload of 100 per cent., and are made for 2 to 25 amperes, at 250 and 500 volts. Fig. 4 is a cross-section of the cartridge and cap, and fig. 5

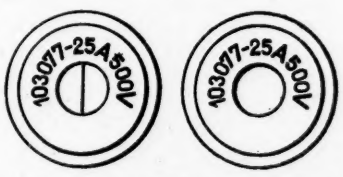


Fig. 5.—Appearance of Whole and Blown Fuses.

shows the appearance of the "dial," when the fuse is whole and when it is blown respectively. The fuse wires are of pure silver, electrically-welded to the top and bottom contacts, and the indicating wire is of constantan in parallel with the main fuse, which is fused when the latter blows.

Various accessories are provided for use in connection with the system, particulars of which are given in a pamphlet recently issued (No. 3).

"Leskole" Distance Thermometers.

The use of electrical instruments for the measurement of temperature at a distance has gained so wide a vogue of late, that it bids fair to become universal. The method adopted may be either by variation of resistance, or by thermo-electric effect, and both these systems are utilised by the Leskole Co., Ltd., of Palace Works, Enfield. Fig. 6 shows their marble switchboard with indicator and contacts for fire nickel resistance thermometers, which are made up for rooms in the form shown in fig. 7, and for water under pressure or steam, as in fig. 8, with glands. The electrical supply on this system is derived from a small accumulator, and a special contact is provided into which the plug is inserted to adjust the instrument to suit the voltage of the battery by means of the regulator shown on the board. When this adjustment is correct, the pointer will stand over a red mark on the scale; on inserting the plug in any of the other contacts, the temperature at the corresponding point will then be indicated correctly. The switchboard is also supplied with a smaller indicator, of round pattern.

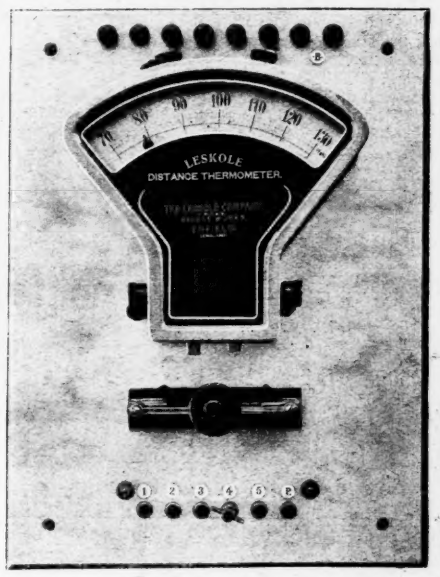


Fig. 6.—"Leskole" Temperature (Resistance) Indicator for Five Stations.

In the thermoelectric system the instruments are similar in appearance, but the adjustment is different; the scale must always commence at the temperature of the cold junction, and therefore a special setting arrangement is provided to enable the pointer to start from that point, so that the scale is direct-reading. For temperatures up to 1,100° F. the thermo-junction is of iron and constantan; up to 2,300° F. a patent carbon-nickel couple is used, and

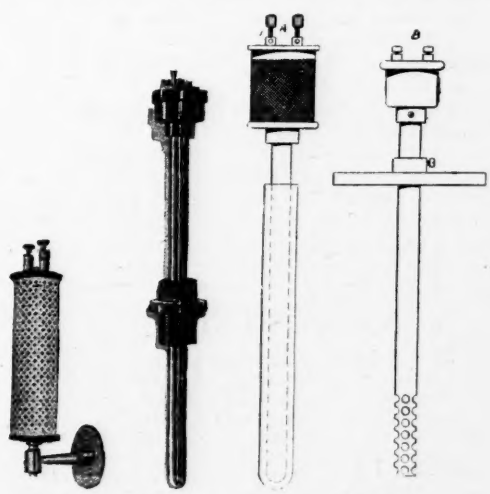


Fig. 7. Fig. 8. Fig. 9.

Fig. 7.—Resistance Element for Air Temperature.

Fig. 8.—Resistance Element for Steam, &c.

Fig. 9.—Thermo-Elements for Annealing-Furnaces and for Flue Gases.

up to 2,900° F. platinum and platinum-rhodium junctions are employed. The elements are mounted in a variety of ways to suit the requirements met with in practice, of which two types are shown in fig. 9. Temperature recorders are also made by the company. One of their resistance pyrometers, tested at the National Physical Laboratory, gave a remarkable result, the corrections being zero from 362° to 570° F., and + 2 at 635° F.

New "Twinob" Switch.

Messrs. A. P. Lundberg & Sons, of 477-487, Liverpool Road, Islington, N., have sent us a sample of their latest improved "Twinob" switch, with a capacity of 20 amperes (*i.e.*, 10 amperes

each way), in which the movement has been completely rearranged. The switch is now made with knife contacts, of the double-break quick-break type, with mica insulation. Many applications are suggested for this switch; for instance, it is well adapted for use in connection with cooking and heating apparatus, enabling variations in the rate of heating to be effected with a single switch. Again, the two levers can readily be coupled together, giving a switch of 20 amperes capacity on a 3½-in. base, breaking the circuit at four points simultaneously; these large currents often have to be handled in houses, now that electric heating and cooking are coming into vogue. With the levers coupled, but the bridging-strap cut, a D.P. switch of 10 amperes capacity is obtained; and if one of the contact arms is spring controlled, so that it cannot be left on, the switch is suitable for a starting switch for A.C. motors.

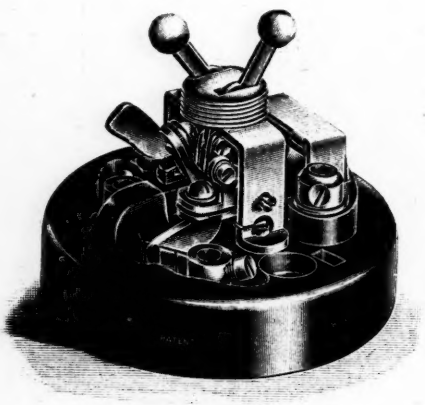


Fig. 10.—New Twinob Switch, Cover Removed

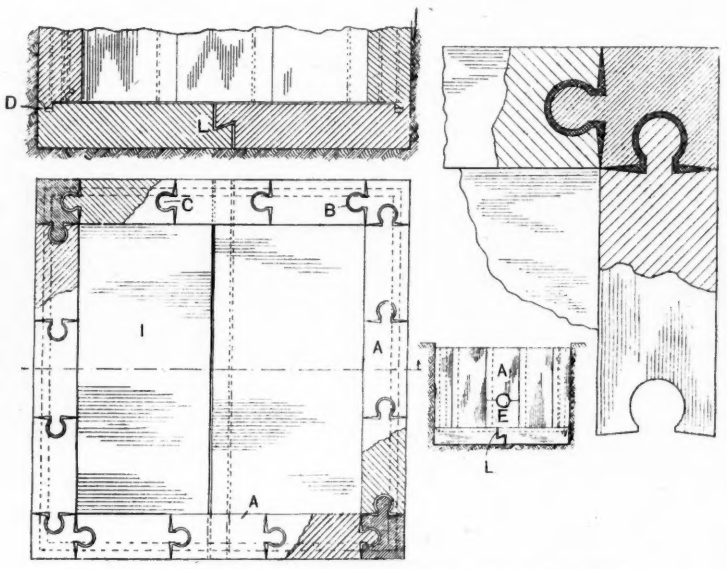


Fig. 11.—Plan and Details of a Gas-proof Street-Box.

New Gas-proof Street-box.

We were recently favoured with an opportunity to inspect a new type of street-box for electricity supply mains, patented by Mr. A. Champion, of the Electrical Department of the L.C.C., and made by Messrs. Telling Bros., of 540, Raymouth Road, South Bermondsey. Mr. Champion's long experience has led him to the conclusion that explosions in street-boxes are primarily due to the percolation of gas into the box through the brick walls and floor; instead of ventilating such boxes to carry off the explosive mixture of gas and air, he proposes to strike at the root of the trouble, and to prevent the ingress of gas altogether. This object is accomplished by the use of impervious slabs of artificial stoneware, as shown in the accompanying fig. 11. The essential feature of the system is the method of ensuring the tightness of the joints. It will be seen that the side-slabs, AA, are provided with a groove B and tongue C, which mechanically lock the parts together, and give a long path through the joint; the two slabs I forming the floor are jointed with a kind of half-dovetail, as shown at L, made tight with Portland cement, and the side walls are set in cement on this floor, after which cement grouting is poured into the vertical joints, making the whole box practically monolithic and gas-proof. A noteworthy feature is the provision of a water seal all round the joint of the side walls and the floor, as shown at D, permanently ensuring the tightness of this joint, as the water cannot dry out. For the admission of the cable ducts, divided side slabs are used, with holes as shown at E. To make the joint tight with the outside of the pipe, grouting is poured down through a hole left in the substance of the upper section of the slab for that purpose. The cover consists of similar stoneware slabs of suitable shape, with the usual standard cast-iron manhole cover in the middle.

From an inspection of one of these boxes, which was built up in a few minutes, we have come to the conclusion that they should effect a great saving of time and labour. Directly the hole is dug, the parts of the box can be quickly put together and the whole thing completed in an hour or so, a matter of importance seeing that such boxes are almost invariably situated on the side-walks, and their construction obstructs traffic and annoys frontagers. Further, the slabs are only half as thick as a brick wall, and therefore take up less room under the pavement where space is precious, besides requiring less excavation by about half a ton of soil. When completed, the box is proof against gas and water, is everlasting, and has a very clean and smooth interior. The ends of the ducts round the cables can be sealed with bitumen, as of course it is useless to make the box gas-tight, if gas can still get in through the ducts. The design can easily be modified to suit varying conditions, at small cost; it is extremely simple, and should prove of considerable utility to station engineers.

AERIAL TELEGRAPHS ON ENGLISH RAILWAYS.

[COMMUNICATED.]

The construction of a telegraph route alongside a main line railway presents more difficulties than are usually imagined. The presence of curves, junctions, signal boxes and station buildings, &c., calls for the exercise of a sound judgment, born of a wide experience, if the pole line is to reveal the work of an engineer rather than that of a novice. The latter, having been warned of the seriousness of a breakdown to the overhead equipment, commences to build telegraphs along the *foot* of an embankment, acting on the hypothesis that a route so placed is less exposed to the fury of the elements. And when in due course the work is completed, it is discovered, among other things, that the front stays are foul of the structure gauge. In order, therefore, to comply with the Board of Trade regulations in this particular, the stays are moved nearer the poles, thus necessitating, in their altered position, an abnormal use of outriggers so as to prevent electrical contacts.

Profiting by experience, the novice intends building his next line of poles along the *top* of the embankment because of the sky-line back view which such a position affords in the observance of faults. But even in this project, his opinions undergo a change and his survey a modification, after receiving a hint that the proper place to build telegraphs is along the *middle* of an embankment. Speaking generally, the site last-named permits of excellent staying facilities without sacrificing the lineman's view of the wires; it is, moreover, unlikely to interrupt the signalman's vision concerning the passage of trains or of his clearly seeing the outdoor signals.

There is also the engine driver to be considered. Obviously, the occupant of the footplate should have an uninterrupted view of the signals controlling that section of line into which his train is about to enter. Yet in the neighbourhood of sharp curves and obscure crossings it requires both ingenuity and skill to avoid complaint. The presence of a few telegraph poles, though satisfactory in other respects, may easily obscure the sight of a signal-arm, which obscurity in certain eventualities might lead to serious results. Neglect of these vital matters would clearly indicate that the person responsible for the erection of telegraphs had not considered the subject in all its ramifications.

The following notes are not intended to cover the whole ground of telegraph construction on railways, but merely to point out those features that distinguish present-day practice from the methods employed at an earlier date.

Poles.—With the exception of square standards built for purposes of ornamentation, practically every telegraph pole on a railway embankment is creosoted. How long these will safely withstand the exposure to rain, hail, wind and sleet seems to be largely a matter of conjecture. In his valuable paper before the Institution of Electrical Engineers, on "Wooden Poles for Overhead Transmission," Mr. Wade gave the life of creosoted wood poles as 50 years, but he later admitted that this estimate was too high. In one or two instances that have recently come under the notice of the writer, several creosoted poles, marked "1870," are being renewed owing to the presence of "dry rot" and to structural alterations. The curious feature is that the poles referred to are still sound at the ground line, decay having manifested itself in the direction of the arms and wires.

Greater regard is paid to the strength and stability of a line than was the case in former years. Every fifth pole—or thereabout—is heavier than the intermediate ones, throughout the route. These heavy poles are stayed longitudinally as well as laterally, in order to minimise the damage that would be caused if a pole were knocked over consequent upon a train derailment. Without such safeguards the sudden breakage of the line-wires would probably wreck the aerial telegraphs from one signal-box to the other.

Contrary to popular notions, the number of poles per mile should be much the same, whether the route is on the main line or elsewhere; or whether the number of wires to be carried is great or small. At one time it was customary to space the poles on branch lines from 90 to 120 yds. apart. To-day, however, the distance between one pole and another is from 60 to 70 yds.; frequently it is less and rarely more. The reason for this change is not far to seek. During recent years electric safety devices have multiplied to a surprising extent, and the old electric appliances have been either modernised or scrapped. The regulations of the various railway companies are enforced with an exactitude that contrasts strangely with the laxity of bygone times. A private telephone wire may remain broken in a back street for several days, and nothing seems to happen, but if a railway "block" wire becomes discontinuous it is an event to be dealt with in a special manner. The "space" interval of working is at once substituted for the "time" interval system, and every train along that particular line of rails is brought to a stand at the signal box. After the lapse of a specified time limit, each engine driver is apprised of the state of affairs and then allowed to proceed cautiously into the next section, this practice being continued until block communication is re-established. Meantime the district lineman will have been sent for, and whether by night or by day he is expected to—and generally does—attend to the fault with promptitude.

The object of this procedure is, of course, to ensure the safety of the passengers, and though the method above described may seem a trifle crude, it is better to incur delay than to risk a mishap. Hence the importance of a railway telegraph route being installed with due regard to permanency, and afterwards maintained in a state of efficiency.

Notwithstanding the advantages that can be tabulated in favour of A poles, the latter have an extremely limited sphere of usefulness by reason of the wire and insulator difficulties in the region of the lower arms. It has been truly said that symmetry of construction and exactitude of detail form very important elements in securing immunity from inductive disturbances. This consideration alone suffices to show the superiority for railway requirements of single poles and those of the H type in preference to twin poles of the A class. In contributing to a discussion upon this subject 3½ years ago, Mr. Frank Gill, of the National Telephone Co., is reported to have stated that "it was possible to carry 100 wires on a single pole 70 ft. high, and one of the reasons why telephone people had not gone in for A poles was that they did not give the necessary arm space." In these words Mr. Gill voices the general objection, and though it must be remembered that the obstacles which have to be surmounted on railways differ widely from those along main roads, yet the quotation is worthy of more than passing notice.

It is well known that many railway sections are in close proximity to the sea coast. The operation of digging holes for the reception of telegraph poles in these localities is often accompanied by an undercurrent of sea water that percolates far inland. If the requisite depth had been reached and the pole reared in position, the only trouble would be that of effectual punning, but it too frequently happens that the rectangular cavity in the ground is quickly transformed into a shapeless puddle. This inconvenience can be reduced to a minimum if workmen are instructed to dig holes and set poles when the tide ebbs.

Wires.—Without discussing the relative merits of copper, bronze and iron, it will suffice to point out briefly that (*a*) the value of copper wire, of which the tensile strength has been raised by drawing, has long been recognised by telegraph engineers, and its use is finding increasing favour on the great railways of this country. Several companies have erected no other kind of wire than hard-drawn copper during the past decade.

(*b*) Bronze wire has much to recommend it for aerial purposes in exposed situations, by reason of the fact that the breaking strain, weight for weight, is greater than that of iron or of copper. Bronze wire is mad up of copper, 95 parts; tin, 4 parts; and zinc, 1 part.

(*c*) Galvanised-iron wire was at one time exclusively employed for telegraph lines on railways because of the prohibitive price of copper on the one hand, and the inherent defects in its manufacture on the other. With the advance of time, both these disabilities were removed, market fluctuations

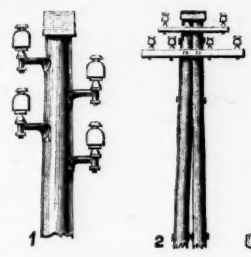
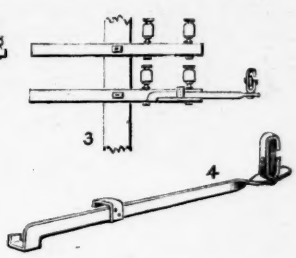


Fig. 1.—Single Pole, with Bracket Insulators.

Fig. 2. "A" Pole.



Figs. 3 & 4.—Showing a Wire Runner.

operating favourably in regard to the former, and scientific improvements with respect to the latter. It is an unfortunate truism that iron wire possesses a high electrical resistance; it is also highly electromagnetic, whilst its perishable characteristic in smoky districts need not be enlarged upon. Therefore it will be understood that the observations hereafter made are confined to the erection of copper wire, since the tendency on English railways is to adopt this class of wire, representing, as it does, "the survival of the fittest."

If care is exercised in the erection of copper wires, it is amazing what a length of service can be extracted and how few faults develop. Even amidst murky surroundings, it is not an uncommon experience for a copper wire to last 20 years, at the end of which period its scrap value is considerable. Workmen accustomed to the manipulation of iron wires are apt to display contempt for the instruction which forbids them dragging a copper wire along the ballast, over the arms or across a stay, but with a courteous firmness on the part of the authorities, the correct method of paying out a wire is soon realised and the rules faithfully observed.

With a view to the prevention of faults during the process of renewals, special contrivances have been designed which vary in shape and name according to their functions.

A "wire runner" is depicted in figs. 3 and 4. It consists essentially of a thin iron bar, bent at one end to grip the underside of the pole arm, the remote end being fitted with a pulley through which the line wire is passed. An iron clamp is riveted to the bar so as to engage with the pole arm on its upper side. This contrivance is equally useful when erecting a new wire or renewing an old one. As a "wire runner" would be required on several poles simultaneously, it follows that a gang foreman should be supplied with eight or ten of them. Joints pass freely through the pulley, and the facility with which a labourer can fix these "wire runners" on the pole arms adds to their utility.

Another ingenious arrangement is roughly sketched in

fig. 6. Its special object is to accomplish the twisting of four telephone wires during working hours. It will be readily understood that by revolving the telephone wires, inductive disturbances arising from neighbouring telegraph wires can be avoided. Let it be assumed that four wires, hitherto run on the straight, have to be revolved. The first operation is to unbind the wires on four consecutive poles, insert the revolving drum on pole A, and join the four wires thereto, through the ordinary tension vice—connecting the line wires across the pole by means of loose G.P. wire. The remaining poles B, C, D, are each fitted with a × piece of wood, the size of the latter being determined by the available arm space. The wires having been temporarily removed from the insulators are then inserted in a separate groove, one at each extremity of the wooden × piece. Thus furnished with the necessary equipment, the twist is made by the workmen—one of whom is up each pole—and the time occupied in carrying out an alteration of this kind is less than a minute. In practice, eight spans are usually dealt with at one time, but in order to simplify the explanation only four spans have been referred to. Experience has shown the wisdom of running two or four new wires on the straight, and afterwards revolving them in the manner stated.

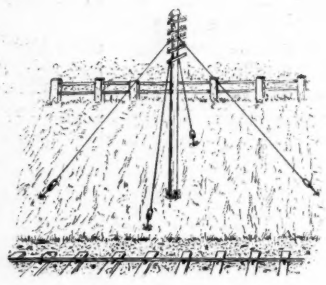


Fig. 5.

Fig. 5.—The solid construction of aerial telegraphs is a marked feature of English railways. The use of 48-in. arms on single poles permits of the revolving twist being carried out more effectually than when 24-in. or 33-in. arms are employed. The staying of poles in the line of wires is also an important item in present day renewals.

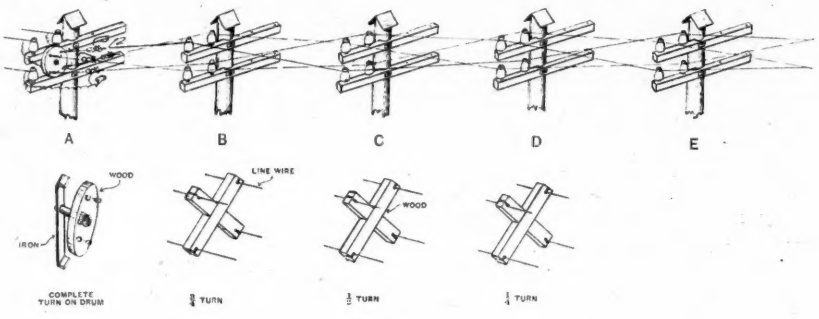


Fig. 6.

Fig. 6.—A method of revolving railway telephone wires which provides for the twist being carried out in a right-hand direction as shown above. It will be observed that the wires make a complete revolution in four spans of the line, so that they are brought to the same average distance from all external disturbing influences.

As regards the regulation of wires, excellent information is available in the Technical Instructions issued by the Post Office, and attention is directed to their data on sags and stresses, and the mathematical considerations on which those figures are based. Copper wire is used very largely on P.O. telegraphs, and the regulation concerning "the factor of safety" is treated so fully that no excuse is needed in quoting from it.

"In designing all engineering works it is the practice to provide a sufficient margin of strength to guard against the failure of any structure when carrying its maximum load. This margin is termed the *factor of safety*.

"For ordinary structures not exposed to sudden shocks a strength equal to four times the highest stresses they have to meet is considered sufficient; that is, a factor of safety of four is allowed,

"For telegraph lines the question is somewhat difficult to legislate upon for circumstances differ materially in different localities, and the conditions affecting a telegraph line, are not paralleled in ordinary engineering works, for the elasticity and elongation of materials when seriously strained, which would be fatal in the latter, often secure the safety of the former. Practical experience has shown, however, that the following factors suffice:—Each wire is exposed to one-quarter its breaking strain at 22° F. Apparently this would imply that when snow equal to three times the weight of the wire had accumulated thereon, it would be on the verge of fracture. As a matter of fact, however, under these conditions the elasticity and ductility of the metal would come into play, the dip of the wire would be increased, and the stress diminished. Cases have occurred when an ice accumulation equal to 30 times the weight of the conductor has formed on the latter before it broke."

Much could be said in favour of an insulated copper line wire which is being extensively employed in automatic track circuits; indeed, it is of special value on any short-line circuit where the avoidance of contact from other current wires is of paramount importance. Space, however, forbids further encroachment, and the concluding note will have reference to the question of fixing copper line wires to the insulator cup.

Many people imagine that the tying of a wire to an insulator is of trifling moment, but the statement may be ventured that in the construction of aerial telegraphs few details are of greater importance. There have been issued at different times single and double-lap binders; clips, wedges and sheaths; binders, cylindrical and of the tape variety. Without dilating upon the meritorious qualities that distinguish the various patterns, it may be said that, in the writer's experience, none have proved more satisfactory than a cylindrical binder of No. 16 gauge soft-drawn copper and 38 in. long, thus allowing for a double lap and a double cross. The type of binder here mentioned and the method of securing the line wire to the insulator is identical with that of 20 years ago, when galvanised iron wire was the vogue (except, of course, that the binders were formerly iron), thus indicating that there is much to be learned from a peep into the past.

Low Power Costs.—In a paper read last month before the North of England Institute of Mining and Mechanical Engineers, Mr. Simon Tate described the electrification of the underground machinery at Trimdon Grange Colliery. This work included the remodelling of the haulage and pumping plants, which were steam driven, and were replaced by electrical plant. For the supply of the necessary energy two Parsons mixed-pressure 350-KW. turbo-alternators are installed, generating three-phase 40-cycle current. These turbines use the exhaust steam from two winding engines, one fan and a small surface hauling engine during coal-drawing hours, supplemented by live steam from coke-oven boilers at other times. Westinghouse-Le Blanc jet condensers are fitted, with a Harrison spray cooler for the circulating water. One generator supplies the whole of the electrical plant, consisting of a 250-H.P. Sulzer pump, five 150-H.P. haulages, a 12-H.P. endless haulage and a 75-KW. transformer, 2,750/220 volts, for the surface and underground lighting. From the indicator-cards of the reciprocating engines supplying the exhaust steam there is approximately 800 H.P. available. The motors installed amount to 1,200 B.H.P. During January last the plant ran for 722 hours, and generated 182,000 units; the maximum observed load was 620 KW., and the load factor 41 per cent. The average load during the day is 275-350 KW., with peaks to 600 KW., which load can be maintained by exhaust steam. Since the completion of the electrical installation it has been found that the running cost at the switchboard is about 0·045d. per unit, and the total cost does not exceed 0·15d. per unit after allowing for interest on capital and depreciation. The plant generates rather less than 2,000,000 units per annum.

Naturally, the discussion turned largely on the low costs, the figure of 0·15d. being cited as a record, and one at which a power company would find it impossible to do business. It was suggested that this low figure for electrical energy was being obtained because they still retained wasteful and inefficient winding engines, on which they were possibly losing money—in fact, they were perhaps robbing Peter to pay Paul.

THE GLASGOW BRANCH OF THE SMOKE ABATEMENT LEAGUE.

By JOHN B. C. KERSHAW.

In a recent issue of this journal some account was given of the work of the Smoke Abatement League of Great Britain, as set out in the first annual report of that body. In the present article information of still more recent date will be given relating to the most useful educational work carried on during the past winter by one of the branches of this League, namely, that known as the Glasgow and West of Scotland Branch of the S.A.L.

The objects of this branch are described in its constitution as follows :—

(*a*) To promote such consolidation of, and improvement in, legislation, as would secure smoke abatement, and to join with other branches throughout the country, in furthering the objects of the League.

(*b*) To take steps to institute lectures and spread information among the public by pamphlets and leaflets, and generally to carry on an active propaganda against the smoke nuisance.

(*c*) To approach the Glasgow and West of Scotland Technical College and other educational institutions regarding the establishment of lectures on combustion and furnace management for firemen and boiler attendants, with a view to the granting by the League of certificates of competency.

According to the rules of this branch the number of members shall be unlimited, and shall include both sexes. All inhabitants of Glasgow and the West of Scotland interested in the question of smoke abatement are eligible for membership.

Each member subscribes 2s. 6d. per annum, and any deficiency of funds for carrying on the work of the branch is to be met by voluntary contributions of the members.

The honorary president of the branch is the Lord Provost of Glasgow—the Honourable Archibald McInnes Shaw. The Provosts of all the neighbouring towns on the Clyde have accepted office as members of the Council, while the list of Vice-Presidents includes many of the more notable public men and manufacturers of the West of Scotland.

No time has been lost by this branch, which was only instituted on February 2nd, 1910, in commencing an active educational propaganda in Glasgow upon the subject of smoke abatement, on the lines indicated in the "objects" of the branch as set out above.

Two courses of evening lectures were arranged for the winter months, the first intended to teach working boiler engineers and firemen the scientific principles underlying their craft, and the second directed towards the education of their employers—the manufacturers, shipowners and general public.

The series of lectures for firemen consisted of five similar courses of 12 lectures each, delivered by the Glasgow Municipal Sanitary Officers and Smoke Inspectors in different centres of the working-class portion of the city, a fee of 5s. being charged for the course. The education authorities of Glasgow and Govan granted the use of suitably situated elementary schools for these lectures, and it is stated that 186 firemen and engineers registered their names as students at one or other of the various centres, and attended the courses. In the majority of cases the employers paid the fees, and urged the men to attend regularly.

The series of nine lectures for the general public were free, and were made attractive by the aid of limelight views and experiments. They were delivered in the large hall of the technical school by several gentlemen connected with the health and medical departments of the University and city, and covered such subjects as :—

"The Black Smoke Problem," "The Necessity for Pure Air," "The Chemistry of Combustion," "How to Fire Steam Boilers without Smoke," &c. Among the lecturers were :—Profs. Glaister and Patterson of the University ; the City Analyst ; the Chief Engineer of the Scottish Boiler Insurance Co., and Mr. Peter Fyfe, the Chief Sanitary Inspector of Glasgow.

It is confidently hoped that this educational work will produce some effect upon the emission of black smoke from the chimneys of works situated in and around the city of Glasgow.

As regards the present position in the city in respect of prosecutions and fines, the Chief Sanitary Inspector of Glasgow (Mr. Peter Fyfe) has informed the writer that the clause of the Local Act of Parliament, under which proceedings are instituted against the owners of smoky chimneys in Glasgow, is weak and requires strengthening. The clause reads as follows :—

Sec. XXXI.—"Every person who so uses, causes, permits, or suffers to be used, any furnace or fire within the city except a household fire, so that smoke issues therefrom, unless he proves that he has used the best practicable means for preventing smoke, and has carefully attended to and managed such furnace or fire so as to prevent as far as possible smoke issuing therefrom, shall be liable for the first offence to a penalty not exceeding 40s., and for a second or any subsequent offence, if committed within 12 months of the immediately previous conviction, to a penalty not exceeding £5."

The defect of this Clause consists in the absence of any cumulative penalty for persistent offenders under the Act. Each 12 months forms a closed period, and every manufacturer starts with a clean record when 12 months since the last offence has expired.

MISTAKES IN TENDERS.

[FROM OUR LEGAL CONTRIBUTOR.]

When preparing the tender for the carrying out of a large contract it is by no means difficult for the contractor to make a mistake in his figures. He often has to work against time, and he is bound to entrust some of the detail work to subordinates. Finally, he may have been misled as to the prices at which he can obtain materials.

If a mistake is made and the tender is accepted, has the contractor any remedy ? Of course if the tender has not been accepted, he may withdraw it. So if he made a tender by post one night, and discovered an error in the morning, he might withdraw the offer by a second letter. In such a case the withdrawal would be good, unless a letter of acceptance had been written and posted before the letter of withdrawal was received.

As mistakes are not usually discovered until a much later stage, it becomes necessary to consider in what circumstances they can be put right.

It is clear law that if a mistake is unilateral, that is to say, a mistake made by the party tendering, and not known to the person who invited the tender, the contractor cannot escape liability.

For instance, in a recent Scotch case the defender offered to execute work for the pursuers for the lump sum of £859. His offer was accepted. He afterwards found that, owing to an error in calculation made by his son, the offer was £326 less than it should have been. In an action for breach of contract the defender having pleaded that this mistake released him from his contract, the Court held that he was not released—the mistake having arisen through no fault of the pursuers—and that the pursuers were entitled to damages.

In another case a tender for the supply of granite to the plaintiffs contained the words, "weather and other circumstances permitting." These words were struck out by the plaintiffs' clerk, and the defendant was informed of the fact. No reply having been received from him for several days, the contract was sealed. Delays having occurred owing to bad weather, the plaintiffs sued for breach of contract. It was held that they were entitled to recover.

In another case (Johnson *v.* Islington Union, 1909, 73 J.P., 172), the facts were as follows :—The plaintiff saw an advertisement in the paper, inviting tenders for the supply of certain goods required by a Board of Guardians. He tendered on a printed form supplied by the Guardians

for the supply of a certain disinfectant manufactured by him. The tender was accompanied by a sample of the disinfectant labelled "Anite," which was delivered to an officer of the defendants. On the printed tender the defendants had asked for a tender for "Heydozone," and the plaintiff omitted to alter the work "Heydozone" into the word "Anite" on the tender, so as to make the tender agree with the label on the sample delivered. The defendants accepted the tender of the plaintiff for the supply of "Heydozone." It was held, on the facts, that the plaintiff had failed to show that the minds of the two contracting parties were not *ad idem*, or that the defendants had misled him in any way and that consequently the contract was binding upon him.

Where, however, there is a mistake in a tender which, being the result of a mutual error, has effect to prevent the contract carrying out the real intention of the parties, the Court will intervene to rectify the contract—for instance, in Neill *v.* Midland Railway, 17 W.R., 871, a railway company advertised for tenders, and issued a form of tenders and schedule of quantities. The builder signed a contract in 1866 to execute the works required at the prices set forth in his tender and schedule of quantities. The specification for the erection of the building was annexed to the contract. The builder made mistakes in filling up the schedule. In 1868 he discovered them, and filed a Bill in equity to have them rectified, alleging knowledge of the mistake of the defendants' engineer, and he obtained rectification. Again, in Collins *v.* Dublin County Council (1908), Ir. R. 503, the plaintiffs, who were building contractors, tendered to the defendants for the building of an asylum. The defendants, deeming the cost too high, directed their quantity surveyors to prepare bills of reductions, showing reduced works and reduced prices. Owing to a reference letter being displaced, there was an error in the total cost as appearing from the bills of reductions, the total sum being put at £830 less than the correct figure. The plaintiffs, in the mistaken belief that the aggregate cost of the reduced works was as stated in the reduced bills of quantities, tendered for one bulk sum, which tender was accepted by the defendants and the works were completed. It was held in an action for rectification, that the mistake could be rectified to carry out the real intention of the parties.

These few cases should serve to illustrate the necessity for taking the utmost care in getting out the figures on which to base a tender. Of course a mistake may sometimes occur to the benefit of the contractor: but this is unlikely, for the person inviting tenders is able to check the figures of the successful tenderer with those of the other contractors who have made quotations.

BRITISH TRADE WITH SWITZERLAND.

The British Vice-Consul at Zurich, in a recent report, states as follows: "In connection with the assertion that there is an opening for more trade from the United Kingdom to Switzerland than has hitherto been the case, I venture to think that our manufacturers and traders under-estimate the commercial importance of this country. Although it is true that in point of area and resident population the country is small, yet it cannot be denied that her trade with the markets of the world is increasing, and in 1909 reached the considerable amount of £108,000,000, thus surpassing other countries of greater extent and larger population. It should not be forgotten that Switzerland does not import manufactures for re-exportation; the only imports approaching this description are unfinished cotton textures, which are embroidered and then re-exported. Her purchases of manufactures, therefore, are all the more important, since they are almost exclusively to meet home requirements.

"The imports into Switzerland from Germany of finished goods in 1909 amounted to 59 per cent. of the total purchases from foreign countries. The general impression is that Germany's trade to Switzerland is so extensive because she sends mostly cheap classes of goods, but this is altogether an erroneous idea. The demand for goods of high-class quality in Switzerland has gradually increased during the last few years in consequence of the steady commercial progress of the country. The condition of the working classes has materially improved of late years, and owing to higher wages they are now in a position to buy goods of better quality. There are many classes of merchandise, notably machinery, copper and brass goods, &c., in which the share of our exports to Switzerland, is somewhat insignificant as compared with the total value of the Swiss annual imports.

"It has sometimes been asserted that the Swiss import duties and the rates of freight from the United Kingdom to Switzerland are prohibitive as compared with those to which the imports from other countries are subject. But the Customs returns of 1907 show that the aggregate duty on the imports from all countries of the goods mentioned above only amounted to 6 per cent. of the value imported, and as we enjoy most favoured-nation treatment, we are no worse off than our competitors in this respect. As regards the expenses of freight, the charges for manufactured goods from Manchester, Bradford or Leeds, to Basle or Zurich, are no higher than those from Berlin or Bremen, and merchandise from London can be sent *viâ* Antwerp to Basle, at the rate of 7 fr. per 100 kg. for any quantity up to 10,000 kg.

"I have in previous reports frequently referred to the desire of Swiss merchants for a more equally balanced trade between the two countries, and in proof of this, the following notice in the principal commercial journal in German-Switzerland, in reference to my report of last year, is deserving of the attention of our exporters. After expressing satisfaction that the British imports showed a more favourable result than in the previous year, the journal added:—

"'The British Vice-Consul has done well in pointing out other classes of goods besides cotton yarns and tissues in which the trade from the United Kingdom to Switzerland could be increased. It would certainly be desirable for Switzerland if the suggestions made in his report to British manufacturers should prove successful. His statement that any efforts on the part of British traders in this respect would meet with the sympathy of the Swiss is justified, since the United Kingdom has long been, and continues to be, the most important market for our goods.'

"In a former issue, the same journal, commenting on my remarks on this subject in an earlier report, said:—

"'There is no reason why we should give German and French commercial travellers the preference if British goods are equal in finish and price.'

"Before leaving this subject, I would again recommend to the consideration of our traders the suggestions which I have from time to time offered as to the manner in which British trade with Switzerland might be improved.

"A personal investigation of the requirements of the Swiss market either by the principals of firms or by their representatives, is most desirable. There are many firms who send their travellers to Germany, France, Austria-Hungary and Italy, and the visit to the principal centres of trade in Switzerland (Zurich, Basle and Geneva) might well be included at a little extra expenditure of time and money. The representative might first call on the British Consuls in these towns, who would be able to assist them in giving information as to the principal firms engaged in their branch of commerce. Season tickets available for 14 days on the Federal Railways can be obtained at a very reasonable cost. In 1909 only 61 commercial travellers from the United Kingdom visited Switzerland, a number quite out of proportion to the extent of the Swiss imports. If, however, it is not possible to send travellers, the appointment of Swiss agents, able to correspond in English, would be the most likely way of securing a better share of the trade. A further aid to the development of British trade in Switzerland would be the sending of price lists and circulars in the French and German languages. In the great majority of instances in which catalogues in the English language are sent no results can be expected. Price lists should be compiled with the weights and measurements given in kilogrammes and metres, and the prices quoted in francs, the latter including freight and duty to destination. I may here say that it is almost useless to draw up these price lists giving our English weights, measures and currency. Switzerland, in common with the whole of the Continent, is accustomed to the metric system of weights, measures and currency, and British traders will do well to adapt themselves to foreign customs in this respect if they wish to increase their trade."

BUSINESS NOTES.

Allahabad Exhibition.—At this Exhibition the pulsometer pumps of the Pulsometer Engineering Co., Ltd., received a gold medal.

The Way of the German in South America.—For some time past our contemporary, the *Engineer*, has been publishing an excellent series of articles by "a Special Commissioner in South America" on "The Progress of Engineering in South and Central America." The writer's twenty-ninth article, written from Bolivia, has just appeared, and we make the following extract from it:—

"In Bolivia, as elsewhere throughout Spanish America, the Germans are rapidly increasing the volume of their trade connections, and from numbering fifth or sixth among nations in the matter of importations of foreign goods, they now come second on the list, Great Britain still being first. The success which these enterprising Teutons meet with is quite comprehensible when one comes to realise the systematic manner in which they organise their business and the whole-hearted thoroughness with which they carry it out. I have upon previous occasions referred to their methods of cultivating and extending their commercial relations in such countries as Guatemala, Honduras, Colombia and Venezuela. Here in Bolivia they are obtaining almost as strong a hold over foreign trade as they have already secured in these other States. They are not content with sending out samples and catalogues, as so many British and American houses do, but they despatch emissaries

to the scent of action, and any day one may witness a number of young Germans busily proceeding from warehouse to warehouse with attractive-looking samples, and pattern books in their hands, making personal calls upon and cultivating the friendly sentiments of the native retailers, or, again, they may be met with in the banks discussing financial affairs, and in many other business connections. When the German comes out here, he comes to stay, allowing no ideas of "home" or absent friends to divert his mind from business, at which he works conscientiously and indefatigably from dawn to dusk. He deserves to succeed, and he does succeed, and much as we may suffer from his industry and deride his self-abnegation, we cannot but admire his thoroughness of purpose and envy him his commercial instinct. At any rate, we cannot, as a trading nation, afford to despise his keen competition and capabilities, and if Great Britain is desirous of retaining first place on the list of Bolivia's foreign customers it will be necessary to emulate the Germans in at least some of their business methods. Gradually they have crept up to the second place. How long will it be, at this rate of progress, before they have displaced us and obtained the first?"

Consular Notes.—Canada.—The Austrian Consul at Montreal reports that there has been a considerable development in land transport in Canada in the way of the introduction of electric railways, which not only serve the large towns themselves internally, but have also been utilised for passenger transport between towns relatively far distant. For goods transport electric railways have been utilised only to a small extent, although, taking into consideration the vast water powers which exist, it may be expected that in the near future many of the ordinary railways will be electrified. Such a development of electric railways has not yet reached the stage of practical projects, however, and although some projects are at present being evolved, it may be many years before anything really comprehensive is done. In the year ended June 30th, 1909, there were in Canada 988 miles of electric railways working; the amount of capital invested was $691,000,000, and the number of passengers carried was 314,000,000, of which about one-third were in Montreal.

The telegraph system in Canada is only in part a Government undertaking, and for the most part is exploited by the great railway companies. In 1909 there were 32,000 miles of telegraph line, of which only 7,225 miles were exploited by the Government. Of the latter, moreover, a very important part—2,252 miles—were to the Yukon district. The number of telegraph stations is about 3,000. The Government control, in addition to their telegraph lines, submarine telegraph cables to a length of 334 miles. The companies chiefly engaged in the exploitation of telegraph systems are the Canadian Pacific Railway Co., the Great North-Western Telegraph Co., and the Western Union, and in the year 1908 6,132,000 telegrams were handled.

The telephone is in much more general use, both for business and private purposes, in America than in Europe (69 per cent. of all the telephones in the world are in use in North America), and a great expansion of the use of the telephone is being witnessed in Canada, where 130,000 instruments are already in use. In Ontario and the Eastern Provinces, the Bell Telephone Co. has almost a monopoly, whilst in the Province of Manitoba, and also in Sakatchewan, telephone systems have been installed by the Provincial Governments.

Spain.—The French Consul in Spain reports that there is an excellent opening there for electrical machines and apparatus, but in order to secure business, it would be necessary to study carefully the terms granted by competitors, and to quote accordingly. Depôts and warehouses on the spot are in a very favourable position, and in order to obtain orders, quotations should be made free at destination. The terms of payment are different for large and for small units; for the former it is customary to demand half payment on delivery, and half payment at 30 days; for the latter payment is usually at 30 or 90 days, sometimes with 3 per cent. discount.

Manufacture of Lamps in Canada.—According to *Commercial Intelligence*, the Canadian General Electric Co. propose to extend their works at Peterborough, Ontario, with a view to engage in the manufacture of lamps.

Private Meetings.—The General Incandescent Co., Ltd., 52, Great Eastern Street, London, E.C.—A meeting of the creditors of the above was held on March 22nd, at the offices of Messrs. John McLaren, Reid & Co., chartered accountants, 150, Leadenhall Street, E.C. It was reported that an extraordinary general meeting of the shareholders of the company was held on March 6th last, when a resolution was passed that the company could not continue its business by reason of the liabilities, and that it was advisable to wind up the concern voluntarily. A further resolution was passed appointing Mr. J. J. Reid to act as the voluntary liquidator of the company. The chair was taken by the liquidator, who submitted a statement of affairs which showed that the assets were estimated to realise £1,924, and a deficiency was thus disclosed of £408. The chairman stated that the liabilities included a sum of about £700 which was due to the Armorduct Manufacturing Co., an action having been brought against the company by that firm. Amounts of a little over £200 were also due to Mr. Moore and Mr. Davis, two of the directors of the company for moneys advanced. The opinion was expressed by one of the principal creditors that the company should not have gone into liquidation, but that some arrangement might have been entered into. A suggestion for compulsory liquidation did not meet with the approval of the creditors, and, after a short discussion, it was decided to confirm the appointment of the present liquidator. A committee of five of the principal creditors was also elected.

The Price of Aluminium.—A report was recently circulated from Paris to the effect that the French producers of aluminium had come to an arrangement with the Neuhausen Aluminium Industry Co., fixing the minimum sale price at 2 fr. per kilogramme. A Frankfort newspaper, however, reports from a reliable source that the statement is incorrect, as no negotiations on the subject have taken place.

Electric Traction in Turkey.—A Constantinople telegram to a German newspaper announces that the firm of Lenz and Co., of Berlin, is negotiating with a view to securing a concession to construct a double track electric line from one point of the European Bosphorus to another. The scheme is estimated to involve an expenditure of £1,680,000.

Patent Amendment.—Messrs. Brown, Boveri and Co., Ltd., are applying for leave to amend two patents, particulars of which appear in our advertisement pages to-day. The patents are:—No. 19,626 of 1906, for "Improvements in or relating to electrically-driven ring spinning machines," and No. 7,612 of 1908, for "Improvements in or relating to ring spinning machines."

Book Notices.—*The Russian Year Book, 1911.* Compiled by Howard P. Kennard, M.D. London: Eyre & Spottiswoode, Ltd. Price 10s. 6d. net.—This is the first issue of an entirely new work, to which we must wish long life and prosperity. The vast region dominated by the Russian Empire, a market of immense value and unlimited possibilities for the future, is to most Englishmen a *terra incognita*; but in these days of intense industrial competition no outlet for our manufactures should be neglected, least of all so fertile a field as this huge agricultural country, whose products are complementary to ours. Under the existing *entente*, too, the conditions are particularly favourable to the development of closer relations, and such works as the one before us should greatly aid in the process. The present issue consists of some 370 pages of text and two excellent maps, and contains a mass of general information regarding Russian affairs, commercial customs, laws, resources, statistics, &c. The next issue, it is stated, will be exclusively commercial, financial and statistical. We can cordially recommend this book to all who have, or wish to have, business dealings with Russia; indeed, it should prove indispensable to them.

A Guide to Commercial Finance. By Alfred G. Deacon & Co. Manchester: 2s. 6d. net.—This is a small book covering 118 pages, with 23 chapters upon sundry commercial matters of general interest. The subjects embrace, *inter alia*, "Principles of Finance" (occupying about a single page), "Gross Profit," "Net Profit," "Monthly Returns," "Balance Sheet," "Purchase of a Business," 'Branches," "Credit," "Costing Accounts" (five pages), "Advantages of an Audit," "Advantages of a Private Limited Company," "Specialisation in Business," and "Bad Debts." Obviously in such a limited space the treatment of many of the subjects must be of a very superficial character. The book is written by Messrs. A. G. Deacon & Co., chartered accountants, whose name and professional calling appear on the back and on the title page in prominent type. We are told that "the purpose of the book is to present in general, and, it is to be hoped, interesting terms, some of the topics that frequently come under the notice of business men." The book, which is written in simple language, contains much that is useful, but that much we should assume would be familiar already to the ordinary intelligence of the ordinary practical business man. By students and others proposing to submit themselves to accountancy examinations, however, it may be read with considerable advantage. Perhaps one of the longest chapters in the book, not unnaturally, is that on the "Advantages of an Audit," which are, of course, beyond dispute. The book strikes us as being one that might usefully be given to existing and potential clients.

Die Elektrischen Erscheinungen in Metallischen Leitern. By Dr. F. Baedeker. Brunswick: Fried. Vieweg & Sohn. Price M. 4.—In this little book a great deal of the available information on the passage of electricity through metallic conductors has been brought together, and has been uniformly considered from the point of view of the electronic theory. This theory is, of course, still far from complete, and in many directions offers only the merest outline of an explanation of the experimental facts, but in some ways it has proved itself of the greatest use, and its embrace is steadily increasing. Without going much into the details of manipulation, the experimental results established up to the present time are fully considered under the headings of: Conductivity in pure metal; Temperature coefficient of conductivity; Conductivity in alloys and mixtures; Heat conductivity and its relation to electric conductivity; Thermo-electric effects, with a suggested theory of them based on Richardson's theory of the emission of electrons from glowing metals; The Hall effect and other curious effects, due to the combined action of currents of electricity or currents of heat flow and magnetic fields; The optical properties of metallic conductors, and the passage of electro-magnetic waves through conductors. The corresponding theoretical explanations are given with the use of a minimum amount of mathematics, but, unfortunately, in so condensed a form that only readers with considerable previous familiarity with the subject will be able to follow them fully. As a suggestive guide to an investi-

gation of this important subject the book can be thoroughly recommended, but at the same time a little more space given to a close consideration of the physical meaning of the theoretical results would add considerably to the value of the next edition.

The Port of Hull Annual for 1911. Hull: H. E. C. Newham, 10A, Bishop Lane. 1s., plus postage.—A great deal of information is contained in this annual regarding the dock and transit facilities, also the trade, of the port of Hull, and concerning the great developments of the Humber district.

In *The Secretary*, February and March issues (Chartered Institute of Secretaries, London Wall, 6d.), a serial article appears from the pen of Mr. George Johnson, F.C.I.S., on "The Argentine and Brazilian Exchanges," which should be interesting to men on the commercial side of the electrical and engineering industry whose attention is occupied with business transactions with or in these countries.

"*Bulletin* Scientifique de l'Association des Elèves des Ecoles Speciales." February, 1911. Liége: *Imprimerie Moderne.* Price 0.75 fr.

"Electrical Engineering Abstracts: Journal of the International Institute of Technical Bibliography." Vol. II, January, 1911. London: International Institute of Technical Bibliography. 24s. per annum.

Dissolutions and Liquidations.—Uxbridge and District Electric Supply Co., Ltd.—A special meeting was held last Friday at the Board of Trade Offices, Carey Street, W.C., of the shareholders of the Uxbridge and District Electric Supply Co., Ltd., which went into compulsory liquidation in June, 1909, upon the petition of Callender's Cable and Construction Co., Ltd. The company was formed in June, 1899, the intention being to apply for a provisional order granting a monopoly for the supply of electricity to Uxbridge and the adjoining districts. The failure was attributed to want of working capital and loss of business caused by the closing down of customers' works. Accounts were filed showing liabilities £59,290, against assets £75,038, but a deficiency of £10,526 as regarded the contributories.

Mr. H. E. Burgess, Official Receiver, presided. The business of the meeting was to consider a scheme of arrangement which provided, *inter alia*, for the stay of a debenture-holder's action; the redemption in cash of the outstanding £35,000 5 per cent. first mortgage, and £15,000 6 per cent. second mortgage debentures; and the issue of £75,000 5 per cent. debenture stock secured by a trust deed, the trustees of which are to be Mr. Henry Drake, and Sir J. Fortescue Flannery, Bart., M.P. The present share capital of the company consists of £26,275 divided into 5,255 fully paid shares of £5 each, and under the scheme each shareholder will be entitled to retain one-fifth of his present holding, conditionally upon the remaining four-fifths being transferred, at the company's expense, to Callender's Cable and Construction Co., Ltd. As soon as the company is taken out of liquidation new directors of the company shall be nominated by Callender's Cable and Construction Co., Ltd., with a view to their being elected by the shareholders in due course. Upon the scheme being sanctioned by the Court a sum of £53,000 paid by Callender's Cable and Construction Co., Ltd., to the liquidator of the company shall forthwith be repaid; all the property and assets of the company in the hands of the liquidator or the debenture-holders' Receiver shall be handed over to the company, and the business of the company shall be resumed by the new board of directors; the company and Callender's Cable and Construction Co., Ltd., shall execute the before-mentioned trust deed, and the company shall thereupon issue the £75,000 debenture stock and proceed to redeem the outstanding debentures to satisfy the claims of all the remaining creditors of the company, to pay all costs, expenses, &c., in relation to the debenture-holders' action, to the scheme and the liquidation generally, to pay the remuneration of the debenture-holders' Receiver, and any other sums directed by the Court to be paid, and to apply the balance for the general purposes of the company.

The chairman reported that he had received proxies from holders of 3,483 shares to vote in favour of the scheme. There was no opposition, and a resolution was unanimously passed approving the scheme and authorising the liquidator to take the necessary steps to give effect to it.

North British Electric Power Syndicate, Ltd.—Creditors should send the usual particulars to the liquidator (Mr. A. Wood, 695, Salisbury House, E.C.), by April 15th.

The British Tungsten Lamp Co.—In the Companies' Winding-up Court, on Tuesday, March 28th, Mr. Justice Swinfen Eady had before him a petition by McKenna and Another for the compulsory winding up of the British Tungsten Lamp Co., Ltd. Counsel stated it was a petition by two creditors who had obtained judgment against the company, with costs, the total amount being £145. His Lordship: Does the company appear? Counsel said he was instructed that the company did not appear. His Lordship made the usual compulsory order.

The Automatic Trolley Head Co., Ltd.—This company is winding up voluntarily. A meeting of creditors will be held at 82, Victoria Street, Westminster, on April 3rd. Liquidator, Mr. H. S. Foster.

Bankruptcy Proceedings.—Joseph Perkins, electrical engineer, of Ebrington Street, Plymouth. Before the Registrar (Mr. F. B. McCrea), at Stonehouse Bankruptcy Court on March 21st this public examination took place.—Replying to the Official Receiver (Mr. A. N. F. Goodman), debtor said he came to Plymouth eight years ago, prior to which he had been both a journeyman in London and a partner in a concern at Birmingham. On coming to Plymouth he had no capital, but obtained employment as a journeyman. Two years after he set up business in Edith Avenue. He canvassed for orders, and did the work himself. He then moved to Acre Terrace, which, like Edith Avenue, was a private locality. He took an office in Princess Square. He removed to Ebrington Street two years ago, where he did a small business in contracts. His turnover did not exceed £700 a year. Since 1908 he took seven apprentices. The highest premium he had received for taking an apprentice was £80, and the lowest £20. It depended on the ability of the boy engaged whether the premium should be £20 or £80.—Do you consider you were justified in a small business of this description in taking no less than seven apprentices? I thought so.—Was there work for them to do? Yes, as a rule.—Was there anybody to teach them? Yes.—Is it not a fact that they were left more or less to their own resources? Oh, no.—The Official Receiver, after putting further questions, said it was impossible, for some reason or other, to get a straight answer to a straight question. It would almost give one the idea that debtor had something he wished to conceal. The only inference to be drawn was that the business was carried on at a loss from the start. He applied that the examination be adjourned, debtor to file a better deficiency account, showing in particular how his losses in business were made up. The examination was accordingly adjourned until April 20th.

Ludwig Lehmann, merchant, 68, Basinghall Street and 26, Milton Street, E.C.—This debtor attended last week for public examination before Mr. Registrar Brougham at the London Bankruptcy Court. The accounts showed total liabilities £16,108 (unsecured, £12,180), and net assets valued at £7,711. In the course of an exhaustive inquiry, the debtor stated that he was a German Jew, who came to England in 1889 or 1890, and had since taken out letters of naturalisation. He commenced business in 1890 as a general merchant in the hardware trade, and was of opinion that he had traded successfully throughout. The failure was due to the excess of drawings for personal expenses over the profits. Witness explained the opening of a number of new accounts by the fact that he embarked upon the sale of electrical and incandescent light fittings. Mr. Tindale Davis, on behalf of Mr. E. H. Hawkins, the trustee, drew the debtor's attention to a sale to one Leo Kaiser, for cash, of £400 worth of incandescent and electrical goods, which he (debtor) had not paid for. Witness denied that he sold those goods below cost price. Asked regarding a consignment of electrical lamps obtained from Siemens Bros. Dynamo Works, Ltd., he replied that he could not say whether he sold those goods to Leo Kaiser or to the United Lighting and Maintenance Co., or to whom they were sold. He was certain, however, that they were not sold at 50 per cent. under cost price. He was not aware that they had been bought by a company called the Sun Co. Witness further stated that he had had large dealings with the United Lighting and Maintenance Co., and had given their names as references, but only on one or two occasions. He had also given as a reference a Mr. J. W. May, who had offices next door to those occupied by the United Lighting and Maintenance Co., in Saracen House, Snow Hill. Leo Kaiser was a commission agent who placed orders with witness for delivery to customers direct. In addition to the £400 cash dealings, witness held dishonoured bills to the extent of £227, given in payment for other goods supplied to Kaiser, but those bills did not appear in the cash or goods accounts. When the sitting was adjourned for a week, the learned Registrar pointed out that the bankruptcy petition was filed against the debtor in March, 1909, but it was adjourned from time to time, it being stated that the debtor only owed the petitioning creditors debt of £58, and that he was interested in property in Canada which would bring in sufficient to meet that claim. It appeared that the whole of the present debts must have been contracted since the filing of the petition. Mr. Osborn, on behalf of the debtor, intimated that his debtor would give a full explanation upon that point before the examination was concluded.

The following are creditors for electrical goods supplied, viz.:—

Best & Lloyd, Ltd.	£49
British Tungsten Lamp Co., Huyton Quarry	133
British Westinghouse Electric & Manufacturing Co., Ltd.	30
Cryselco, Ltd.	67
Edison & Swan, Ltd.	176
Foster Engineering Co.	90
General Electric Co., Ltd.	62
Guest & Chrimes	36
Glover & Co., Ltd., W. T.	46
Imperial Lamp Works (Brimsdown)	103
Kreek, G., Berlin	161
Pope's Electric Lamp Co., Ltd.	58
Plutte Scheele & Co., Ltd.	212
St. Helens Cable and Rubber Co., Ltd.	55
Simplex Conduits, Ltd.	217
Drake & Gorham, Ltd.	86
Fully Secured.	
Baxter & Caunter	64
Geipel & Co., W.	53
Partly Secured.	
Bryant Trading Syndicate, Metallite, Ltd., Highbury (security valued at £70)	144
Dittman, G., London (security valued at £299)	466
Grammont, A., London (security valued at £226)	409
Siemens Bros. Dynamo Works, Ltd. (security valued at £161)	170

Edward Wm. Barton-Wright, Albemarle Street, Piccadilly, electrical patentee, &c.—An application was made last week to Mr. Registrar Giffard at the London Bankruptcy Court for an order of discharge. Mr. W. P. Bowyer reported that the debtor failed last October with liabilities £3,946 and no assets whatever. He was the founder and managing director of the Bartitsu Light Cure Institute, Ltd., which went into liquidation in November, 1908, and he afterwards managed the business until December, 1910. Between 1904 and 1910 he had attempted to exploit several inventions, in connection with some of which he incurred losses, and he was also a director of a paint manufacturing company from 1906 until its liquidation in 1908. The debtor attributed his insolvency principally to his having been unable to dispose of

shares which he held in the before-mentioned companies; to loss of £500 in connection with an electrical entertainment given at Amsterdam in 1908; to a further loss of £2,000 in connection with a patent electric accumulator, and to other causes. As offences the Official Receiver reported (1) insufficiency of assets to equal 10s. in the £ on the amount of the liabilities; (2) contributing to the bankruptcy by rash and hazardous speculation; (3) a previous bankruptcy; and (4) misconduct in deceiving the Court and obtaining a stay of advertisement and a rescission of the receiving order in the said previous proceedings by concealing from the Court certain of his then existing liabilities.—His Honour upheld the report, and imposed a further suspension of four years.

Loxton Hunter, trading as the Pax Patents Co. at Durham House, John Street, Adelphi, W.C., dealers in electric and other patent novelties.—The public examination was held on Friday, March 24th, before Mr. Registrar Brougham at the London Bankruptcy Court. The statement of affairs showed liabilities £719 and assets valued at £270. Witness attributed his failure and insolvency to friction between himself and the inventor of air gas; to expenses incurred in demonstrating and exploiting the patents, and to want of capital. The examination was concluded.

James Marshall Vaughan, electrical engineer, Three Queen's Lane, Bristol.—An application was made to his Honour Judge Austin, sitting at the Guildhall, Bristol, on Friday last, for the discharge from bankruptcy of the above-named debtor. The failure occurred in March, 1906, and a dividend of 8d. in the £ had been paid. The failure was attributed to loss of £350 on a contract. The discharge was granted subject to a suspension of two years.

Meter Contracts.—The Electrical Apparatus Co., Ltd., have secured the York contract for electricity meters up to and including 5 amperes, and the Ilford contract for electricity meters.

Trade Announcements.—Walter Duckett, formerly on the staff of the Austin Motor Co., Ltd., and latterly representing Chas. Taylor, of Birmingham, is no longer connected with the latter firm. He has formed the Moss Gear Co., Ltd., Crown Works, Pool Street, Aston, Birmingham, and will specialise in cut gearing, including silent gearing for motor drives of every description, worm reduction gears, &c.

Messrs. Holophane, Ltd., 12, Carteret Street, Queen Anne's Gate, S.W., announce that they are now in a position to supply the trade with the new residence line of Holophane reflectors, in which they have endeavoured to combine artistic effect with efficiency.

Messrs. Estler Bros. have just removed their head office to larger premises at 15, Dowgate Hill, Cannon Street, E.C.

Mr. J. E. Lester announces that his electrical and garage businesses are now combined, and carried on at new premises at 40, Humberstone Gate, Leicester, under the name of J. E. Lester and Folwell, electrical and motor-car engineers.

Mr. E. C. Amos has removed to 22, Martin's Lane, Cannon Street, London, E.C.

The Walsall Electrical Co., Ltd., announce that they have appointed Mr. C. Gunner, of Derwent Lodge, Croydon Road, Anerley, London, as their London agent, and he will deal with all inquiries and orders for the London district.

Messrs. Haslam & Schontheil, Ltd., are to-day removing their offices, showrooms and stores to 11, Windsor Place, Cardiff, where they will carry larger stocks of electrical supplies, cables, lamps, &c., and have a well-equipped electric fittings showroom.

Meters Approved.—According to notices appearing in the *London Gazette* for March 24th, the Board of Trade has approved of the following meters:—

Westinghouse type A polyphase watt-hour meter, deposited by the British Westinghouse Co., Ltd.

Hookham two-rate meter, deposited by Chamberlain & Hookam, Ltd.

Ferranti polyphase watt-hour A.C. meter, deposited by Ferranti, Ltd.

Three-phase induction watt-hour meter, type D 3, deposited by the Electrical Co., Ltd.

Aron polyphase motor meter, type H, deposited by the Aron Electricity Meter, Ltd.

Catalogues and Lists.—The General Electric Co., Ltd., 67, Queen Victoria Street, London, E.C.—32-page neatly produced booklet (No. S 1,450) entitled "Street Lighting by Osrams." It contains a great deal of information that should be of value to the engineers and committees who have to do with the public lighting of our cities and towns, railway stations, and so forth. The object of the publication can be best explained by the following quotation: "This booklet has been prepared in order to add to the 'powder and shot' of the station engineer and his municipal or director colleagues in the present campaign against gas." What is being done by means of Osram high candle-power lamps in a number of areas is briefly described, and quite a collection of street views at night—lit by Osrams alone—are included. There is a table showing the approximate cost of electricity consumed by these lamps per 100 hours at prices ranging from 3d. to 7d. per unit. Life test curves from a National Physical Laboratory report are also given. What cannot fail to be a very serviceable pamphlet comes to a close with a couple of pages of illustrated lanterns suitable for street lighting.

The Edison & Swan United Electric Light Co., Ltd., have sent us their leaflet No. F 2,217, dealing with the Ediswan decorative material for the Coronation; this includes transparencies, wood letter signs, illumination strip, and various imitation flowers, lanterns, and necessary accessories, with prices.

The Sun Electrical Co., Ltd., 118/120, Charing Cross Road, London, W.C.—12-page catalogue giving full particulars and prices of their illuminated devices for Coronation celebrations. The "Suncolite" strip, holders, globes, rosettes and other decorative accessories, miniature strip for outlining devices or buildings, crowns and letters, illuminated transparencies, switches and cut-outs, ironclad switches and fuses, and "Sun" incandescent lamps are all detailed and illustrated.

Messrs. Siemens Bros. & Co., Ltd., Caxton House, Westminster, S.W.—Supplement No. 11 to Electro-Medical catalogue No. 506, in which is given a description of their Diathermy or Thermo-penetration apparatus, that is, the heating of the human body by high-frequency currents, also for the voluntary destruction of diseased tissues through coagulation. We understand that the treatment is receiving a good deal of attention in medical circles just now A second publication reprints a paper by Dr. Nagelschmidt, of Berlin on "The Thermal Effects Produced by High-Frequency Currents and the Therapeutical uses of Diathermic Treatment.'

Messrs. Krupka & Jacoby, 11, Queen Victoria Street, London, E.C.—Leaflet giving prices of "Graetzin" metal-filament lamps for low and high voltages and candle-powers.

Messrs. David Shanks & Co., Ltd., 115, Wainwright Street Aston, Birmingham.—Illustrated price list of illuminated electric signs, exit signs, cinematograph theatre fittings, electric light fittings, fire shutters, &c.

Mr. G. Braulik, 8, Lambeth Hill, Queen Victoria Street, London, E.C.—New pamphlet (No. 15) of eight pages, giving illustrations and prices of "Eclipse" lighting strip for electrical illumination purposes, also wood letters, crowns, transparencies and various other illumination devices which will serve for the approaching Coronation celebrations. Lamps, holders, cables, accessories, and "Pixielite" strip, are also included.

Messrs. Morris & Lister, Ltd., Coventry.—New list illustrating and describing their time element circuit breakers.

The Union Electric Co., Ltd., Park Street, Southwark, S.E.—New list (No. 1,020), giving in the course of 16 pages, a fully illustrated description of their "Union" direct-current dynamos, including a very wide range of speeds, voltages, &c., in sizes up to 40 H.P. (⅛ to 30 KW.), together with tabulated sizes, outputs, prices, code-words, &c.

The British Central Electrical Co., 84, Hatton Garden, E.C.—New publication entitled "Home Office List," in which they give illustrations, prices, and brief particulars of a range of "Handshield" and shockproof specialities and accessories that they are supplying to meet the requirements of the Home Office and Factory Regulations. Also a leaflet relating to table and desk fans, and sewing machine motors.

Messrs. Siemens Bros. Dynamo Works, Tyssen Street, Dalston, London, N.E.—Illustrated leaflet dealing with 14 new types of Holophane reflectors, which are specially suitable for "Household" use, and have been specially designed to combine artistic effect with the well-known scientific properties of Holophane glassware. The ordinary types of "Stiletto" Holophane reflectors have frequently been regarded as not sufficiently artistic to be used in conjunction with electric light fittings of elaborate design, but the "Household" Holophane reflectors are made in a variety of shapes, suitable for various types of fittings. They are satin-finished inside, whilst the outer surface is of clear glass. Some of the types are specially suitable for wall brackets, having an arrangement of prisms which strengthens the reflection of light in an outward direction, but which screens a certain amount of light from the wall surface. Others are specially suitable for use on vertical lamps, table decorations, and such like. Contractors can obtain quantities of this list, over-printed with their name and address. The latter remark also applies to a new tinted card illustrating the "Samson" suspension for "Stiletto" Holophane reflectors for tantalum or "Onewatt" lamps. This suspension is supplied either with the ordinary type of ceiling plate and hook for direct connection, or with ceiling plate and hook to cover conduit boxes or ceiling roses, so that it can be adapted to any existing installation.

Messrs. Crompton & Co., Ltd., Arc Works, Chelmsford.—New 8-page pamphlet (U 23) in their standard form, giving a full description and prices of their moving coil and moving iron instruments—pedestal pattern—for C.C. and A.C. circuits.

LIGHTING and POWER NOTES.

Ashford (Kent).—The Kent Electric Power Co. has objected to the prov. order for E.L. being sought for the rural districts by the East Kent Electricity Supply Co. Both the East and West Ashford R.D.C.'s have decided to take no action, but to leave the two companies to fight out the matter with the B. of T.

Atherton.—At a L.G.B. inquiry into the D.C.'s application for permission to borrow £5,000 for electricity supply, held on the 23rd inst., by Mr. A. W. Brightmore, it was stated that the Council had already expended £10,000 on the electricity undertaking, which was inaugurated in 1903, and the demand was still on the upward grade. The Council purchases electricity in bulk from the South Lancashire Tramways Co.

Barking.—Draft drawings prepared by the surveyor for the electricity works extensions have been approved, and tenders are to be invited for the erection of the buildings. It was reported to the Electricity Committee that Messrs. Lawes & Co., are adding further plant of the capacity of 65 H.P. to their works at Creekmouth.

Barnstaple.—At a meeting of the T.C. on Monday, the Lighting Committee expressed the opinion that the time had arrived for replacing the present battery, and recommended that a new battery of accumulators be purchased, at a cost of £1,440—the payments to be spread over a period of 10 years—subject to the opinion of the consulting engineer being satisfactory. The report was adopted. Subsequently the Mayor referred to the recent inquiry into the Council's application to borrow money in connection with the electric supply. Dr. Ware said the criticisms of the Inspector at the recent inquiry might have appeared to be a little bit sharp, but they were in no way personal. Subsequently the Inspector paid a tribute to the officials, saying that they were doing their duty.

Beckenham.—Owing to the economy obtained by the use of metal lamps, the saving being placed at 43 per cent., the U.D.C. has decided as a temporary measure, in order to meet standing charges, to suspend the discount, amounting approximately to ½d. per unit on householders' lighting accounts, and to increase the price of current to consumers where no discount has been given, by ½d. per unit, from April 1st. The latter will not affect power users and tradesmen's outside arc lamps.

For Coronation illuminations, current will be supplied at 3d. per unit, plus 2s. 6d. for connecting and disconnecting, and the cost of necessary additional services.

Bradford-on-Avon.—The U.D.C. has instructed the Lighting Committee to make inquiries with respect to E.L. systems in other towns, with the view of securing an installation for the town.

Budleigh Salterton.—A B. of T. inquiry was held on Monday regarding the objections of residents near the site of the proposed electric lighting works. It was stated that there would be no nuisance from noise or smells, and no unsightly chimney; even if a larger engine were needed the noise would not be increased.

Bury.—The Electricity Committee has received the L.G.B.'s sanction to borrow £72,170 principally for a new generating station and additional mains. The Tramways, Gas and Electricity Committees have decided to pay their proportions of the cost of the Bury Corporation Consolidation Act (1909), amounting respectively to £1,769, £750 and £750, out of the reserve funds.

Continental Notes.—Sweden.—The Swedish Minister for Home Affairs has just introduced into Parliament a Government Bill, which proposes to authorise the utilisation of the large waterfalls near Elfkarleby, which is about 93 miles to the north of Stockholm, and a credit of £549,000 is asked for the carrying out of the scheme. It is considered that difficulties no longer exist in regard to the transmission of energy over the distance separating the falls in question from the capital. The project comprises, in the first place, the installation of plant of 22,000 H.P., and a portion of the power would be used for working the eastern branches of the State railways and in the administrative district of Stockholm. The extensions of the plant so as to utilise the whole of the power of the Elfkarleby falls would increase the amount of energy available to 170,000,000 KW.-hours per annum. It is intended to offer the power at disposal after satisfying the requirements of the State, to the owners of the iron and steel works in the large area over which the supply will be available; the wood-working industry and the paper and wood pulp works. As most of these establishments use steam power at the present time, it is thought that the cheaper electric power would impart a great development to the industries, particularly to the iron trade in which electric smelting, it is declared, will soon be employed on a large scale judging from the most recent technical progress.

Austria.—Interested persons in Marburg and Pettau, in Steiermark, have joined forces and nominated a Committee to erect a generating station of a capacity of 53,000 H.P. to supply the towns named with light and power. The scheme will, it is said, be financed by English and Swiss capitalists.—*Zeitschrift für das Gesamte Turbinenwesen.*

Italy.—An American Consular report states that Milan's lighting system is being changed from gas to electricity, and the first and most important of the five water-power plants to furnish the necessary power is now in operation. These five plants are all to be in the Valtelline Alps, in Lombardy, 93 miles from Milan, and are a section of a $6,484,000 project by the Commune of Milan, which carries out both construction and operation. It has not been decided when the other four water-power plants will be commenced.

Crompton.—Mr. F. Swarbrick has approached the U.D.C. on the question of an E.L. scheme for the district, asking if the Council would be opposed to the formation of a company for carrying out an installation. The Council has declined to entertain the application.

Darwen.—The Corporation has applied to the L.G.B. for permission to borrow £7,000 for extensions to mains.

Finchley.—Mr. W. C. Cope, the chairman of the Council, in his annual report for 1910, says with respect to the electricity department: "In connection with the general working of the undertaking, 410 applications have been received for electricity supply, representing 12,000 8-C.P. lamps, of which 10,523 have been connected. The number of applications is somewhat in excess of that for the preceding 12 months. Sixty-three public lamps have been erected. The revenue of the electricity undertaking continues to steadily increase. The fact that the electricity supply of the Council is popular is shown by the number of consumers now totalling 2,419."

Ipswich.—The T.C. has applied to the L.G.B. for a loan of £6,790 for E.L. purposes.

Kettering.—A L.G.B. inquiry was held on March 23rd into the application of the U.D.C. for a loan of £13,100 for electricity purposes. There was no opposition.

King's Lynn.—A net profit of about £1,000 has resulted from the past 12 months' working of the electricity department; it is expected that £300 will be allocated in relief of rates, and that the charges for private lighting will be reduced.

Liverpool.—On the recommendation of Mr. A. B. Holmes (consulting electrical engineer), the Electricity Committee has decided to withdraw as from the end of the June quarter, the restriction limiting the maximum demand system of charging for lighting to consumers guaranteeing to take less than 100,000 units per year; and has agreed that the "rateable value" system be continued for private houses on the terms at present in force, and offered as an alternative method of charging to all other consumers on the basis of a fixed charge per year of 18 per cent. on the rateable value of the premises, and 1d. per unit for each unit metered.

The Mersey Docks and Harbour Board has adopted the recommendation of the Works Committee to provide six electric delivery cranes at Toxteth Docks, at an estimated cost of £1,900.

London.—Fulham.—The B.C. is in receipt of a letter from the L.C.C. suggesting that instead of accumulating so large a reserve fund for renewals, the local authority should make an arrangement for the reduction of the loan periods in respect of loans raised for plant and machinery from 42 years to the period now allowed for such expenditure, viz., 20 years, to be reckoned from the date of the original borrowing. The Electricity Committee remarks that Fulham is accumulating a reserve fund out of which all renewals and replacements of plant and machinery which may become necessary during the currency of the loans will be met, and that the Council cannot acquiesce in the suggestion that the loan periods should be reduced. The electrical engineer reports that extensions of the generating plant are necessary. The most economical size of engine would be one of a 1,500-KW. capacity, and the price would work out at £6,500 for the following:—One 1,500-KW. turbo-alternator, with exciter, Tirrell regulator; condenser, to deal with 30,000 lb. per hour, with air and circulating pumps; steam, exhaust, water and drain pipes, &c.; oil cleaners; altering existing building, foundations, &c.; switchboard additions, comprising two panels, complete with all regulating, measuring, indicating and safety devices, connecting machine and meters, H.T. and L.T. work, &c. He mentioned that he had avoided extending the engine room itself, on account of the very heavy cost involved, and he was of opinion that the carrying out of the work as arranged, would put off spending £3,000 on buildings for, perhaps, two or three years. So far as he could ascertain, it would take six or eight months to deliver, erect and have the machine running. The Committee has confirmed the scheme of the engineer.

Hammersmith.—The Works Committee reports having had under consideration the cost and efficiency of the lighting of the main roads of the borough, especially those lighted by electric lamps. At present the lamps used are arcs of a nominal C.P. of 1,000 and 500, or metallic-filament lamps of from 400 to 100 C.P., while the annual charges paid by the Council to the electricity department are as follows:—Arc lamps, 1,000 C.P., £20 per annum; 500 C.P., £7 10s.; metal-filament, 400 C.P., £17; 200 C.P., £4 19s. 7d.; 100 C.P., £2 14s. Being of opinion that the charges paid to the electricity department for 1,000 and 500-C.P. arc lamps were too high, and the standard of light obtained not satisfactory, the Committee had communicated with the Brentford Gas Co. and the Electricity Committee, with a view of ascertaining what could be done to reduce the cost and increase the efficiency of the public lighting in the main roads. The proposal received from the Brentford Gas Co. to the Committee's inquiry was as follows:—(1) The company will be prepared to run the necessary mains and fix the lamps in any of the principal thoroughfares of the borough free of cost to the Council; (2) the illuminating power of the high-pressure lamps would be 1,000, 1,500 or 3,000 C.P. (nominal); (3) the charge per annum for the lamps, the same being turned out and replaced by two smaller lamps on each standard at 12 o'clock midnight, would be £12 1s. for the 1,000, £13 8s. 6d. for the 1,500 candles, and £22 4s. 11d. for the 3,000 C.P. (this was an inclusive charge); (4) provided a sufficient number of lamps were contracted for on a given length of main there would be no increase on the price per lamp quoted; (5) owing to the large capital expenditure involved, the company would require a contract for a period of not less than 10 years. The company points out that the 3,000-C.P. lamps would be suitable for the more important thoroughfares, while the smaller lamps would be ample for roads where there is not so much traffic. It further points out that there are some roads in the borough which are, at present, lighted by arc lamps, where a low-pressure 400-C.P. lamp would probably be better; these lamps could be supplied, to be alight all night, for an inclusive charge of £8 15s. per lamp per annum. The Electricity Committee sent in a report to the effect that it was advisable to abolish the open arc lamps and to substitute for them clusters of metal-filament lamps; also further suggesting improving the lighting of Hammersmith Road by the erection of five additional standards at an estimated initial cost of £64. Having regard to the above proposals, the Electricity Committee puts forward the following proposals: (1) That 183 arc lamps be removed, and that clusters of four or five (as the circumstances demand) 110-watt metal-filament incandescent lamps be provided in place thereof; (2) that the annual charge be £12 10s. per column per annum with five lamps

in a cluster, and £10 per column per annum with four lamps in a cluster; (3) that five additional lamp columns be erected in Hammersmith Road at an estimated cost of £64 11s. 3d., and fitted with clusters of lamps as suggested above; (4) that the cost of conversion (estimated at £688, plus £64 for erecting the five new lamps) be provided out of the revenue account of the electricity undertaking, instead of out of the general rate, as hitherto; (5) that the small arc lamps remain as at present, but that no new small arc lamps be purchased, and that the existing ones be converted to clusters of metal-filament incandescent lamps as they wear out. The Electricity Committee's scheme, if carried out, would result in a very substantial reduction in the cost of street lighting in the borough, and the actual C.P. of the suggested new lamps is much greater than the actual C.P. of the present arc lamps. Having regard to all the circumstances, the Works Committee is of opinion that it would be advantageous to adopt the proposal of the Electricity Committee, and it has decided accordingly. All of the 100-C.P. electric lamps in the portion of Wood Lane between the Exhibition entrance and Uxbridge Road are to be replaced by 200-C.P. lamps during the period of the Exhibition. The Electricity Committee reports with regard to the supply of three-phase current to the Exhibition authorities, that the Kensington and Notting Hill Electric Lighting Co., Ltd., have agreed to furnish the supply upon the same terms as hitherto, with the exception that the price for all energy taken up after October 15th will be 9d. per unit. The Committee has formulated the following scheme for the supply on hire of wiring and fittings required for external lighting, viz., (1) the Council to supply on hire, fix, and maintain outside lanterns at the following annual rentals, exclusive of any charge for energy supplied, viz., two-light lanterns, 16s. 9d. per annum per lantern; three-light, 20s.; four-light, 25s. (2) The Council to enter into agreements with local electrical contractors for installing outside lanterns as required by consumers, and maintaining the same, upon the following terms:—(*a*) The contractor to supply and fix a three-light lantern (prime cost 8s. 3d.), including all wiring, switches, &c., complete (exclusive of lamps) at the following prices: One lantern, £1 12s. 6d.; two, £3; three, £4 6s. 6d.; four, £5 12s., no more than two lanterns to be controlled by one switch; (*b*) the contractor to maintain the lanterns so installed, including the cleaning of the same once a week, and renewals of tungsten lamps as required, at a charge of 10s. per lantern per annum, payable by the Council to the contractor quarterly; (*c*) the charge for maintenance to include the equipment of the lantern with three 50-C.P. metal-filament lamps in the first instance, and all replacements as required by Clause 2 (*b*). (3) The charges for installing and maintaining three-light lanterns to be accepted as a basis, and modified accordingly for two-light or four-light lanterns.

Lambeth.—The Lighting Committee reports having had under consideration the condition of the 25 public arc lamps belonging to the Council, but lighted and maintained by the South London Electric Supply Corporation, free of charge to the Council, as one of the conditions of the transfer of the late Vestry's electric lighting order to the company. These are now to be replaced with "Excello" flame arc lamps. The approximate C.P. of the new lamp is 3,000, as against the old light of 500 C.P. The Corporation has also promised (*a*) to light the lamps for 3,940 hours each per annum, instead of 3,600 hours as has been the arrangement hitherto; and (*b*) to make such arrangements as will ensure that all the 25 lamps shall remain alight during the whole of the 3,940 lighting hours.

At the meeting of the Metropolitan Asylums Board on Saturday, the Works Committee reported that in July, 1909, the managers decided upon the installation of low-voltage metallic-filament lamps in place of the carbon-filament lamps then in use at the North-Western, Western, South-Western, and South-Eastern Hospitals, the Children's Infirmary, the Downs School, the Western, South-Western, Mead and South-Eastern Ambulance Stations, and the new Central Stores; and subsequently it was decided to install the same type of lamp at the North-Eastern Hospital and at the Tooting Bec Asylum. The Committee now submitted a statement showing the cost of gas and electricity consumed at the above institutions during the years 1908 and 1910, together with the cost of installing metallic-filament lamps. The intervening year (1909) had been omitted from the statement, as the introduction of metal-filament lamps was then in progress. From the statement referred to it appeared that the cost of gas in 1908 was £3,572, and the cost of electricity (carbon lamps) £3,281. In 1910 the cost of gas was £1,911, and the cost of electricity (metallic-filament lamps) was £2,528. Altogether, inclusive of all items, it was estimated that there was a total net annual saving of £3,044. This result had been obtained after due allowance had been made for the increased cost of metallic-filament lamps, and the increased cost of maintaining them when in use. The saving of at least £3,000 per annum as compared with 1908 might, therefore, the Committee concluded, be confidently anticipated under existing conditions.

In connection with the Coronation decorations at the Bank of England, it has been decided to outline the architectural features with electric lamps. According to the *Evening News*, at the Coronation of King Edward VII, the Bank was illuminated with gas lamps, which took four hours to light, the process costing over £20 each time.

Luton.—Additional plant and mains being needed, the T.C. has instructed the electrical engineer to prepare a preliminary report on the matter.

Morecambe.—The Corporation has decided to continue the present mode of lighting the Promenade by electricity, and to purchase 50 Metroflam lamps in lieu of 52 old arc lamps, which are to be returned to the makers, the estimated cost being £405.

Newton-le-Willows.—The new dye works taken over by Messrs. J. F. & E. Caulfield, of Bradford, has been fitted with modern plant, driven by electric power, supplied by Messrs. Mather and Platt, of Manchester.

Pontefract.—The Corporation is applying to Parliament for authority to transfer the electricity undertaking and powers to the Yorkshire (West Riding) Electric Tramways Co., Ltd. Notice appeared in the *London Gazette*, March 24th.

Shipley.—The U.D.C. has passed plans of an economiser and economiser house estimated to cost £660, and the engineer has been instructed to obtain tenders.

Energy is to be supplied for Coronation illumination at 1½d. per unit.

Southend-on-Sea.—The T.C. has decided to continue for another year the present charge of 1¾d. per unit for energy supplied to the tramways.

It is proposed to substitute electricity for gas for lighting the pier.

Stockport.—It is proposed to contribute towards the relief of the rates £19,100 from the profits of the gas department, and £1,300 from those of the electricity undertaking.

Stoke-on-Trent.—The Corporation Electricity Committee has adopted the following scale of charges for electric motive power in the Longton area:—Up to 250 units consumed per quarter, 2d.; over 250 units to 500 units, 1½d.; over 500 units, 1d. Except by special agreement, energy for power purposes is not to be sold at less than 1d. per unit.

Torquay.—At a meeting of the T.C. the annual report in connection with the public lighting was presented. It was shown that the total cost for the financial year (including the electric lighting) was £3,851. Several recommendations were made by the Committee for improving the public lighting. A scheme was presented by the electrical engineer for extending the electricity works. Reference was made to the increase in the supply, and Mr. Salt recommended the installation of a steam turbine set, on the grounds of low capital cost, small cost of foundations, small space occupied, and low working costs. It was necessary for the whole of the additional plant to be installed and running by November 1st. Proposing that the scheme be adopted, and that application be made to the L.G.B. for sanction to borrow £5,000, Mr. E. T. Blackler (chairman of the Committee) said the engineer informed him a short time ago that, compared with other towns of a similar size, Torquay was £4,000 behind in its takings on the private and public lighting supply. The report was adopted.

Worksop.—The U.D.C. has applied to the B. of T. for permission to use overhead lines for the transmission of electricity in certain parts of the district.

The charge for energy for lighting the outside of premises through a separate meter has been reduced to 3d. per unit.

TRAMWAY and RAILWAY NOTES.

Blackpool.—Tramcar travel de luxe is Blackpool's latest enterprise. The Tramways Committee, on March 23rd, had on view the new cars which are to take the place of the ponderous vehicles now in use. The Committee had a trip, and one member, experienced in Continental travel, compared it with the luxurious mountain-climbing trains of Switzerland. The car has a covered top, and the windows are easily lowered on summer days. One of the most pleasant features is the large platform at either end of the upper deck. The car has an 8 ft. 6 in. wheel base, which allows greater comfort for the passengers, and it has special facilities for exit and entrance in busy times. It accommodates 70 passengers, 28 inside and 48 outside. The Committee has already decided to apply for a loan of £1,000 to put tops on the remaining new cars, and on five of the old cars. By this time next year it is hoped to have at least 18 of these cars running.

Continental Notes.—Germany.—Besides the contemplated introduction of electrical working on the section Magdeburg-Bitterfeld-Leipsiz-Hake already announced, further extensive schemes are projected by the State Railway Administration. It is intended, says the *Berliner Lokalanzeiger*, to electrify a series of railways in the upland districts of Silesia. Besides the main track Laubanditterbach-Königzelt, the southern branches of this line are to be electrically worked, viz., the Hirschberg to Grüntal, the Hirschberg to Landeshut, the Ruhbank to Liebau, and the Niedersaltbach to Halbstadt. The funds for these, as well as certain steam railway extensions and improvements, will be provided in the Railway Budget for 1912.—*Elektrische und Maschinelle Betrieb.*

Austria.—Progress with the electrification of the railways in the Etsch Valley is continuous, and the section Bozen to Kaltern will shortly be worked from a transformer station in course of erection at Eppan, which is expected to be ready next month. The power will be supplied by the Etsch station. The cable line

connecting Anton and St. Mendel will also draw its current from the station in the Nun's Valley. By the contemplated use of the water power of the River Argen, the district of the Bodensee will also contribute some power.—*Elektrotechnische Zeitschrift.*

The Austrian Railway Department has worked out a general plan for utilising the water power which will be available when the dam across the Sarn Valley is erected for the generation of electric current for railway working. The plan falls into two sections, the first affording 15,000 H.P. and the second 14,300 H.P. The estimated construction costs of the two stations to be erected are put at about 5,500,000 marks. Lately, a further scheme has been developed in connection with the projected local railway in the Sarn Valley, which it is proposed to extend to the traffic centre at Bozen. In consequence of the special difficulties of the route, the outlay on this extension is estimated at 4,500,000 marks.

The Nordböhmische Electricitätswerke is the name of a company formed at Bodenbach by the Bergmann Electricitäts A.G., with 1,500,000 kronen capital, for the purpose of building railways in Northern Bohemia.

Electric railway development is making steady progress in the districts lying around Innsbruck. Besides the first single-phase installation set up in Europe—the Innsbruck to Fulpmes line—there exists the high-tension Berg Isel-Hungerburg-Hall-i-Tyrol line, the electric cable line in the Hungerburg, and the partly completed main line from Innsbruck to Seefeld, Mittenwald and München. Other projects are an electric cable line up the Grammatboden, a cable suspension railway from the suburb of Hötling up the Vogelhütte, a similar railway up the picturesque Patscherkofel and an electric railway to connect with the charming localities of Mühlau, Arzl, Rum, Thaur and Hall.—*E.T.Z.*

On the subject of the long-talked-of electrical fast train service between Vienna and Pressburg, the *Elektrotechnische Zeitschrift* observes that, now that the last objections are removed, the building should be immediately begun and the line opened for traffic next year. The line will start from the Head Custom House station in Vienna and run to Kaiser-Ebersdorf, Swechat (with a branch to Fischamend), Maria-Elend, Regelsbrunn, Petronell (branch to Hainburg), Wolfstal, Engerau, Ligefalu (on the frontier), across the Danube bridge, and thence to the Krönungshugel in Pressburg. The journey will take 1½ hours, as the precincts of Vienna and Pressburg must be negotiated slowly. A second electric railway for passenger and goods traffic is contemplated by certain interested persons. The line is to start from a point on the existing Vienna to Baden electric railway and run to Rauhenstein, Alland, Heiligenkreuz and Mayerling, terminating by a junction with the Südbahn at Mödling.

Doncaster.—The T.C. has decided to apply to the Light Railway Commissioners for powers to extend the tramways for four miles in the rural district to Woodlands Colliery.

Glasgow.—As already reported in the REVIEW, the Corporation decided to appeal against the imposition on the department of certain municipal taxes levied by the city assessor, and appearing on the valuation roll at full value. The case was heard last week. For the department, it was argued that all the municipal assessments should only be imposed on one-fourth of the total valuation. For the previous two years, the city assessor had charged the tramway department the assessments in question on the full valuation, and the tramways department had paid the charge under protest. In 1908-9, the amount was £15,294; in 1909-10, it was £13,575; and for the current municipal year it is £12,514—in all, £41,384. The city assessor contended that, in view of the decisions of the Law Courts, a tramway was not a railway, and was consequently not entitled to the abatement given to railways. If the department was successful in the appeal, it was only fair that the sum it had paid as taxes should be refunded, but if the department was unsuccessful, he asked that it should pay up the arrears from 1894—when the T.C. first took over the undertaking from a private company—down to 1907. That would amount to £101,328, plus interest. The Court before which the case was heard dismissed the appeal, and the T.C. has decided to bring the matter before the Sheriff of Lanarkshire for an opinion and decision.

Japan.—The Odawara Electric Railway Co. has secured a concession from the Japanese Government for the construction and working of a light electric railway between Yumoto and Gora, a distance of about eight miles.

It is reported that the municipal authorities of Yokohama have decided on the construction of an electric tramway in the city on their own account.

Lanarkshire.—On 23rd inst. an inquiry was opened under the Private Legislation Procedure (Scotch) Act, 1899, at Glasgow, into a provisional order applied for by the Lanarkshire Tramways Co., which sought permission to extend the time for the acquisition of lands and for the completion of tramways, and to make agreements with the various county and local road authorities affected. It was stated for the company that in 1908 it applied for powers to extend the time for the completion of the works originally authorised, but agreed to restrict the period from five to three years. During these three years, which expired in August, the company had constructed the line from Hamilton to Uddingston, a line from Wishaw to Newmilns, and from Motherwell a short section to Holytown and Mossend, a total length of 5¼ miles. Over seven miles of the total scheme still remained to be constructed, but the company had suffered financially from the dearness of money, while in the district concerned the effect of property being subject to subsidence through underground workings had also been experienced. In the course of examination the chairman of the company said it had not applied for more capital during 1910 because trade was bad. He denied that completion of the works had been delayed because the uncompleted portion was in the non-paying part of the district. Had that been the case the company would have allowed its provisional order to run out, and would not have promoted the present application for extension of time. The preamble of the Bill of application was subsequently found proved, and further extension of time granted. On the following day, however, when the parties met for the adjustment of clauses, a somewhat unusual position was created. The point arose over the proposal to insert a clause in the Order providing that if the tramway company failed to carry out the incomplete section of their tramways within the further period allowed, the County Council and neighbouring burgh authorities should be empowered to acquire the whole system at a fair market value. The promoters refused to accept a penalty clause which the Commissioners inserted, making the company liable to pay a sum of £8,000 in the event of their failing to complete their system by August 11th, 1912, and withdrew the Order.

Ringley (Lancs.).—It is reported that negotiations are in progress between the South Lancashire Tramways Committee and the Radcliffe U.D.C. for permission to run cars from Whitefield to Farnworth, thus connecting Farnworth, Kearsley and Ringley with a direct line to Bury.

Southport.—The Corporation electrical engineer has fixed, on behalf of the Tramways Committee, nine electrically-driven synchronised clocks in different parts of Southport for use in connection with the tramway system. Practically at every important junction and each terminus one of these clocks is fixed up, the master-clock being installed at the tramway office in Chapel Street. Two types of clock are in use—those of the Magneta Time Co. and the Synchronome Co.

West Ham.—The B. of T. has sanctioned the borrowing of £10,000 for the car sheds in Greengate Street, Plaistow.

TELEGRAPH and TELEPHONE NOTES.

Constantinople Telephone Concession. — Reuter reports that the Chamber has ratified the telephone concession granted to an Anglo-Franco-American syndicate, as previously announced, and has approved a Bill authorising the formation of an Ottoman company to work the concession.

The German South American Cable.— It is announced that the cable steamer *Stephan* on March 18th completed the laying of the cable between Monrovia and Pernambuco for the German South American Telegraph Co., of Cologne, the work on this section having been commenced from the Pernambuco end, 12 days previously. The European end of the cable, which is to be brought into operation on April 1st, is at Emden, and intermediate landing places are at Santa Cruz, Teneriffe, and at Monrovia on the West Coast of Africa. Since the formation of the company, a period of 2½ years has passed down to the completion of the cable, which has been made and laid by the Nordenham cable works. According to a Berlin newspaper, the object of the cable in the first place is to improve the telegraphic connection with South America, whilst at the same time reducing the rates. In order to obtain the traffic necessary for rendering the cable remunerative, it is suggested that further problems which should come into consideration relate to the provision in the South American Continent of favourable lines connecting with the Pernambuco station, as the commercial world attaches value not only to low cable rates, but also to the delivery of the messages at their destinations as soon as possible. The Argentine Republic, although having a comparatively brisk telegraphic traffic with Germany, will for a time be unable to use the German cable, as that country is contractually under the obligation to send telegrams for the next 25 years by the Western Union Telegraph Co.'s cable between Buenos Ayres and Ascencion. It is, therefore, expected that only such messages will be transmitted from Argentina as can be sent by wireless apparatus to stations in connection with the line of Pernambuco-Emden, or which are expressly desired by the sender to be forwarded over the cable in question. By means of an agreement with the owners of the French cable between Brest and Dakar, Senegal, support is to be given to Pernambuco in case of interruption of the cable, and in order to render this possible the cable stations at Emden and Brest are to be placed in direct cable communication in the ensuing summer. In addition, the two intermediate stations of Monrovia and Dakar have been connected by the addition to the present Dakar-Conakry cable of a cable between Conakry and Monrovia, and it is declared that in the event of interruptions in either the German or the French cable, traffic can always be carried on without much delay by avoiding the faulty section. Telegrams to Senegal, Nigeria, Liberia, &c., have already been forwarded by the German cable, and a coast cable has also been laid from Monrovia to Grand Bassam, on the Ivory Coast. The possibility is afforded of utilising from Grand Bassam the existing connections with Kotonou (Dahomey), Lagos, Bonny, and Duala (the Cameroons), and *via* St. Thomas, gaining access to South and South-West Africa; whilst a large wireless station is being built at Monrovia, and will be able to communicate with the similar stations in the Cameroons.

East Africa, &c. It is claimed that in this way Germany will obtain an almost certain and independent connection with her African protectorates.

South American Cables.—The Birmingham Chamber of Commerce is collecting the opinions of other Chambers regarding a proposition that a British cable all round South America is required, to counteract the great efforts now being made by the United States to promote their trade and hinder that of other countries. It is alleged that the Central and South American Telegraph Co., which has a practical monopoly of the cable business in that part of the world, exercises great influence in favour of the United States' trade.

A Telephone Authority.—In a circular letter to the Press this week, Mr. H. Laws Webb has further ventilated his proposals for the establishment of a telephone authority for Great Britain, independently of the Post Office. He prophesies unsatisfactory results if the telephone system is transferred to the Post Office, which, as he points out, has made a commercial failure of the telegraphs, and compares the working results of the National Telephone Co. and the Post Office, showing that the gross revenue of the former is 21·1 per cent. on the capital employed, of the latter 13·6; the ratio of working expenses to gross revenue is for the company, 58 per cent., for the Post Office 72 per cent.; and the net revenue of the former is 8·9 per cent. on the capital employed, of the latter 3·8. The Post Office royalty is, of course, not included in the National Co.'s figures. In view of these results, and of the enormous amounts of capital required for future developments, Mr. Webb urges that a telephone authority should be created, and points out that this solution of the problem has been adopted by the London Chamber of Commerce and by the Association of Chambers of Commerce.

Wireless Telegraphy.—Trials have just been made at the experimental wireless station at the Darmstadt Technical High School with an apparatus devised by Johann Sacek, of Prague, for the purpose of preventing the interception of wireless telegrams by third parties. It is claimed that the apparatus permits of the maintenance of complete secrecy, and that messages transmitted by it can only be read by the particular station for which they are intended. The invention is stated to represent extraordinary progress in wireless telegraphy.

CONTRACTS OPEN and CLOSED.

OPEN.

Accrington. — March 31st.— Extra-high-tension three-phase feeders, and low-pressure service and feeder cables, for the Corporation. See "Official Notices" March 24th.

Algeria.—April 10th. The Prefectural authorities at Oran are inviting tenders for the concession for the construction and working of an electric tramway, about 29 km. long, between Oran and El-Ancor.

Australia.—May 8th. Battery of accumulators, with boosters and switchboards, for the Melbourne City Council. See "Official Notices" February 24th.

May 16th.—10,000 telephone protectors, for the P.M.G.'s Department in Victoria. See "Official Notices" to-day.

June 14th.—Switchboard, common-battery, multiple, for the P.M.G.'s Department in South Australia. See "Official Notices" February 3rd.

June 14th.—Branching multiple magneto lamp-signalling switchboard, for the P.M.G.'s Department in Victoria. See "Official Notices" February 3rd.

April 25th.—175 miles of telephone cable, lead-covered, paper-insulated, and 717,000 paper sleeves, for the P.M.G.'s Department in Victoria. See "Official Notices" March 10th.

Melbourne. — April 19th. Deputy Postmaster-General. Telegraph and telephone material. Specifications, &c., High Commissioner, 72, Victoria Street. S.W.

July 25th.—Deputy-P.M.G., Melbourne. Twelve sections of a branching multiple magneto lamp signalling switchboard, &c., or one automatic or semi-automatic switchboard, for the P.M.G.'s Department in Victoria. See "Official Notices" March 24th.

Belgium.—April 4th. The authorities of the Ecole de Pyrotechnie, Rempart de Hoboken, Antwerp, are inviting tenders for an electric lighting and power transmission plant at the School.

April 12th.—The Société Nationale des Chemins de Fer Vicinaux, of Brussels (14, Rue de la Science), is inviting tenders for the supply and laying of the underground armoured electric cables required in connection with the light railways in the Charleroi district.

April 26th.—The Provincial Government authorities at Mons are inviting tenders for the concession for the construction and working of an electric tramway between Charleroi and Couillet-Queue.

Blackpool. — The Electricity Committee is inviting tenders for the supply of coal (7,000 or 8,000 tons) for the next 12 months.

Bulgaria.—April 19th. The municipal authorities o Varna are inviting tenders for the concession for the electric lighting of the town.

April 19th.—Tenders are invited for the supply of Varna with electric light. Specifications 30 francs, from the "Burgermeisteramt der Stadt Varna," Varna. Deposit £2,000. A copy, in Bulgarian, may be seen at the Board of Trade C.I. Branch in London.

Cavan.—April 10th. Generating plant and wiring at St. Patrick's College and the Bishop's House, for the Trustees. See "Official Notices" March 24th.

Dudley.—April 9th. Lubricating oils for a year, for the Corporation Electricity Department. See "Official Notices" to-day.

Germany.—April 10th. The Lighting Committee of the Municipal Council of Bremen is inviting tenders for a 300-kw. motor-generator.

The municipal authorities of Pforzheim are about to invite tenders for the construction of the electricity generating station required in connection with the projected system of electric tramways in the town.

Glasgow. — April 24th. Steam turbo-alternator, with condensing plant, for the Corporation tramways. See "Official Notices" March 17th.

Hornsey.—April 24th. Flame arc lamps, for the T.C. See "Official Notices" to-day.

Kirkcaldy. — The E.L. and Tramways Department invites tenders for one year's supply of coal; Mr. O. F. Francis, burgh engineer.

Leigh.—April 1st. One 500-kw. direct-coupled high-speed reciprocating generating set, evaporative condenser, extension to switchboard, and girder work for extension of crane, for the Corporation. See "Official Notices" March 17th.

London. — Hackney. — April 6th. Two water-tube boilers, one motor-turbine feed pump, and reconstruction of portion of the coal-conveying plant, for the B.C. Electricity Department. See "Official Notices" March 10th.

St. Pancras.—April 12th. (*a*) Arc lamp carbons; (*b*) motor-generator and balancer, for the B.C. See "Official Notices" March 24th.

April 12th.—Electric fittings and tubes for three years, for H.M. Office of Works. See "Official Notices" to-day.

300 d.c and a.c. meters and 500 interlocked ironclad fuse-switches or ironclad switches connected to double-pole ironclad cartridge fuses, sizes from 15 to 250 amps., for the Committee of the Electrical Exhibition, Olympia. See "Official Notices" to-day.

Manchester.—April 3rd. Signal, telegraph and electric fittings (form No. 32), and signal, telegraph, and electric light wires (form No. 33), for the Lancashire and Yorkshire Railway Co., for a year; Mr. Waring, Stores Dept., Osborne Street.

April 4th.—The Electricity Committee is inviting tenders for various piping at valves at Stuart Street generating station. Specification and forms of tender from Mr. S. L. Pearce, chief electrical engineer.

Newport.—April 8th. Lubricating oils for the Corporation Electricity and Tramways Departments. See "Official Notices" March 24th.

April 4th.—Electric light installation at the Stow Hill Higher Elementary School, for the Borough Education Committee; Borough Architect, Town Hall (returnable deposit of £1 1s.).

Roumania.—April 18th. The municipal authorities of Tecuci are inviting tenders for the concession for the public and private electric lighting of the town.

Russia.—The municipal authorities of Archangelsk are at present inviting tenders for the concession for the construction and working of an electric tramway in the town.

St. Helens.—April 20th. One 1,500-kw. high-pressure turbo-alternator, with condensing plant and switchgear, for the Corporation Electricity Committee. See "Official Notices" to-day.

Sheffield.—April 10th. Clothing, for the Corporation Tramways Department. General Manager, Tramways Department, Division Street.

Shipley.—The U.D.C. has approved a sketch-plan of the proposed economiser and economiser house (cost £660), and tenders are to be obtained for the work.

Southend-on-Sea.—The T.C. has instructed the electrical engineer to obtain tenders for installing the electric light at the permanent buildings at the Sanatorium.

Stroud.—April 18th. Refuse destructor, for the U.D.C. Mr. G. P. Milnes, engineer to the Council (returnable deposit £1 1s.).

Stoke-on-Trent. — Electricity works plant, for the Borough Electricity Supply Committee. See "Official Notices" March 24th.

Torquay.—April 13th. Turbo-generator, condensing plant and switchgear, motor-generator and switchgear, and electrically-driven feed pump, for the T.C. See "Official Notices" March 24th.

Wallasey.—April 13th. Stores for the Corporation Electricity Department, for a year. Mr. J. A. Crowther, electrical engineer.

Warrington.—April 5th. Extra-high-tension cable and extension feeder panel, for the Electricity and Tramways Committee. See "Official Notices" March 17th.

April 5th.—Manganese steel curves for the Electrical and Tramways Committee. Specifications, &c., from Mr. F. V. L. Mathias, borough electrical and tramways engineer, Howley, Warrington.

York.—April 11th. Reversible booster, switchboard and replating of storage battery, for the Corporation Electricity Department. See "Official Notices" March 24th.

CLOSED.

Barnsley.—The T.C. has accepted the tender of Mr. F. Earnshaw, of Barnsley, for 4,000 tons of nut slack for the electricity works.

Birkenhead.—The B. of G. has accepted the tender of the Easton Lift Co., Ltd., for a full automatic lift, at £332.

Burnley.—The Guardians have accepted the tender of Messrs. Carter & Co., for electrical requirements at the workhouse for the ensuing 12 months.

Croydon.—The Borough Council has accepted the tender of Callender's Cable and Construction Co. for the annual supply of cable.

Falkirk.—Mr. John Gardner's offer for the construction of a concrete tank for the cooling tower at the electricity works has been accepted by the E.L. Committee.

Ipswich.—The T.C. received the following tenders for a high-pressure turbine, driving direct, on the same shaft, two continuous-current dynamos of a total capacity of 1,000 KW., surface condenser, air and circulating pumps, &c. :—

Willans & Robinson (with Siemens Bros.' dynamos), £4,906 (accepted) and £1,756.
Howden & Co., £4,541 and £4,800.
Brush Electrical Engineering Co., Ltd., £4,950.
Escher, Wyss & Co., £5,138.
Richardsons, Westgarth & Co., £5,175.
British Westinghouse Co., Ltd., £5,195 and £5,546.
C. A. Parsons & Co., £5,920 and £5,623.
A.E.G. Electric Co., £6,100.

The T.C. has also accepted the tender of Messrs. G. and J. Weir, Ltd., for a boiler feed pump, at £259.

Leek.—The U.D.C. has accepted the tender (subject to the L.G.B. sanction of a loan) of the Diesel Engine Co. for a 220-KW. engine, coupled to a Crompton dynamo, at £3,570.

Liverpool.—The tender of the Edison & Swan Co., Ltd., for the supply of electric fittings, has been accepted by the Liverpool Select Vestry.

London.—L.C.C.—The Highways Committee received the following tenders for roadwork and platelaying, exclusive of the supply of rails and special trackwork in connection with the construction of overhead trolley tramways from Putney Bridge to High Street, Wandsworth :—

Name.	Tramway works.	Paving works.	Total.
George Wimpey & Co. .. (accepted)	£20,520	£5,890	£26,409
John Mowlem & Co., Ltd.	20,798	5,637	26,435
Kirk & Randall	20,561	5,938	26,499
Dick, Kerr & Co., Ltd.	20,489	6,037	26,526
A. N. Coles	20,729	5,821	26,550
Underwood & Bros.	21,660	5,444	27,104
G. Percy Trentham	27,047	8,182	35,228

Chief engineer's estimates, comparable, £20,877 for the tramway works and £6,264 for the paving works—a total of £27,141.

Messrs. Hadfield's Steel Foundry Co., Ltd, are to supply for £2,612 and £1,387, the special work required in connection with the Battersea Park Road to King's Road, Chelsea, tramways, and the reconstruction of the Highgate Road horse tramways.

For the supply of woodworking shop accessories for the second portion of the central car-repair depôt, the tenders were as follow :—

Thomas Robinson & Son, Ltd.	(accepted)	£143
Buck & Hickman, Ltd.	..	217
J. Sagar & Co., Ltd.	(incomplete tender)	71
A. Ransome & Co., Ltd.	" "	117
Pollock & Macnab, Ltd.	" "	243

FULHAM.—The tenders of Messrs. W. H. Wilcox & Co., Ltd., and Messrs. Alexander Duckham & Co., Ltd., for oil, for the Electricity Department, have been sealed. For the supply of stores during the coming year the following and other tenders have been accepted :—

Electrical goods.—Siemens Bros. & Co., Ltd.; Simplex Conduits, Ltd.; W. White & Co., Drake & Gorham; W. T. Henley's Co.; B. I. and Helsby Cables; General Electric Co.; Electrical Co., Limited.; Veritys, Ltd.; British Westinghouse Co.; Johnson & Phillips.
Frames and covers.—Sykes & Sugden.
Carbons.—Sloan Electrical Co. and W. Geipel & Co.
Glass globes.—City Glass Co.
Copper brushes.—Chaplin Bros.
Carbon.—Le Carbone.
House cut-outs, service boxes, &c.—B.I. and Helsby Cables, and Sykes and Sugden.

WOOLWICH.—The B.C. has accepted the tender of Messrs. Willans and Robinson, Ltd., for the renewal of parts of an engine at Plumstead Electricity Works, at £97.

HAMPSTEAD.—The Guardians have accepted the tender of Mr. Eric Rivers Smith to act as electrician to the Board for 12 months.

Mansfield.—The T.C. has accepted the tender of the Vacuum Oil Co., Ltd., for oil for the electricity works.

Rotherham.—Messrs. Babcock & Wilcox, Ltd., in addition to their already large business in electric cranes, are now specialising in steelworks cranes, and have just secured the contract for a platform-type open hearth charging machine for Messrs. Steel, Peech & Tozer, Rotherham. The machine embodies many recent improvements, and is electrically driven in all motions.

Sale.—The Cheshire Education Committee has accepted the tender of Messrs. Sewell & Varley for the electrical installation at the Sale Girls' High School, at £90.

Shrewsbury.—The contract for electrical work for the Public Abattoirs has been booked by the Shrewsbury office of Messrs. R. FitzMorris & Co., of Worcester, who have lately carried out the lighting of the residence of Mr. David Davies, M.P., at Llandinam.

Southend-on-Sea.—The T.C. has decided to accept the tender of the Chloride Electrical Storage Co. for installing a complete battery at Chalkwell Park, at £5,001, and to maintain it for 12 years at £384 per annum. The tender of the same company has also been accepted for the maintenance of the extended battery at the generating station for traction purposes, at £96 2s. 4d. per annum, in lieu of a previous contract at £73 5s.

Warrington.—The B. of G. has accepted the tender of the Economic Electric Supply Co., of Liverpool, for electrical requisites for six months.

Watford.—The U.D.C. has accepted the tender of Messrs. Drake & Gorham, Ltd., for the alteration to street lanterns, and the supply of metallic-filament lamps for a period of three years.

Willesden.—The U.D.C. has accepted the tender of G. & H. Turner for the maintenance of the telephone system for 12 months.

FORTHCOMING EVENTS.

Royal Institution.—Saturday, April 1st. At 3 p.m. Lecture on "Radiant Energy and Matter," by Prof. Sir J. J. Thomson. (Lecture V.)
Saturday, April 8th.—At 3 p.m. Lecture on "Radiant Energy and Matter," by Prof. Sir J. J. Thomson. (Lecture VI.)

Institution of Electrical Engineers (Yorkshire Local Section).—Wednesday, April 5th. At 7 p.m. At the University, Leeds. Address on "Public Electricity Supply in Country Districts," by Mr. W. B. Woodhouse.

National Electrical Manufacturers' Association (Inc.).—Thursday, April 6th. At 2.30 p.m. At Balfour House, Finsbury Pavement, E.C. Meeting of the Council.

Institution of Electrical Engineers.—Thursday, April 6th. At 8 p.m. Paper on "Wireless Telegraphy Working in relation to Interferences and Perturbations," by Mr. J. E. Taylor.

Chemical Society.—Thursday, April 6th. At 8.30 p.m. At Burlington House, W. Paper on "Chemical Action Induced by Cathode Rays and Canal Rays," by Mr. E. P. Perman; and other papers.

Artificial Transmission Line.—In a paper read before the American I.E.E., Mr. J. Cunningham recently described an artificial transmission line built in the laboratory of Union College, Schenectady. The line consists of 400 glass tubes, each 6 in. in diameter, ⅛ in. thick, 4·5 ft. long, wound with 240 turns of No. 8 copper wire. The tube is lined with tinfoil to provide the requisite capacity. The complete line capacity is 1·135 microfarads; inductance, 0·3944 henry, and resistance, 936 ohms. It has a natural vibratory period of 360 cycles per second, and an equivalent length of 130 miles; its resistance causes it to correspond to a 130-mile line of conductor between No. 1 and No. 2 copper wire. The object of building the line was to investigate and study the various transient and other phenomena in connection with switching, sudden change of load, &c. The paper contains a number of oscillograms taken during such tests.—*Electrical World.*

Leominster E.L. Order.—We are informed that Mr. J. Herbert Edwards, of Bristol, is the promoter of the above order; on page 470 in our last issue, we erroneously mentioned Messrs. Seymour & Co. in this connection.

NOTES.

Copper.—The returns for mid-March, 1911, as received from Messrs. H. R. Merton & Co., show the unusual feature of an increase in visible supplies. For the end of February these totalled 82,387 tons, while for March 15th the quantity was 82,757 tons, or 370 tons higher. Stocks at Havre are down 194 tons, which, however, is compensated for by an increase of 64 tons on English holdings, and 500 tons on the quantity afloat. The stock of copper in Rotterdam is down 100 tons, being now 7,500, and Hamburg is estimated 500 tons lower, being 10,500. American stocks for February 28th show an increase of 6,364 tons over the return for January 31st, and the total world's visible supply for February 28th is put at 152,311 tons, an increase of 5,528 tons over the preceding month.

Detailed supplies for mid-month are, of course, subject to be altered considerably in aspect when the supplies for the whole month are known. As they stand, supplies from North America to this country are above the average, to the rest of Europe about 1,000 tons low; to England from Spain above average, as also to other countries, the latter figure (3,676 tons) being 1,650 tons above the average rate for half a month. Afloat from Chile the quantity is well up, from Australia just average. Supplies exceed deliveries by 370 tons, the amount of increase in European stocks.

Turin International Congress.—At the International Congress of the Applications of Electricity, to be held at Turin in September next, the following will be the official subjects for discussion:—

1. Electrical and mechanical characteristics of modern electric generators, with special reference to very high-speed machines.
2. Present state of technical progress in the manufacture of stationary and traction batteries.
3. On the simultaneous running of several generating plants, all feeding the same system of network.
4. The selection of the transmission and distributing pressure and the design of switchboards and sub-stations in large electrical installations, taking into account both economy in first cost and continuity of service.
5. Underground high-tension networks in metallic connection with overhead lines.
6. Present state of research in reference to abnormal rises in pressure and means of their prevention and protection of the system.
7. Construction and use of automatic circuit-breakers.
8. Methods of cooling transformers of moderate power.
9. Converters, rectifiers and motor-generators.
10. The problem of frequency transformation.
11. Technical and economical influence on the lighting industry of the new metallic-filament lamp and of the metallised carbon arc lamp.
12. Three-phase variable speed motors, with special reference to rolling mills and paper mills.
13. Single-phase traction *versus* three-phase traction on main lines.
14. High-pressure continuous-current traction *versus* single-phase traction on suburban lines.
15. Overhead line construction for electric railways.
16. Direct production of steel from ores by means of the electric furnace.
17. Sterilisation of water by processes employing electricity.
18. Electricity meters, with special reference to different kinds of loads.
19. Government control of meters.
20. Rational methods of commercial measurement of electric power.
21. The problem of increasing the load factor in central stations.
22. Application of electricity to submarine boats.
23. Long-distance wire telephony.
24. Wireless telephony.
25. Automatic telephone exchanges as a means of economy and improvement in telephonic communication in large cities.
26. Research on secrecy in wireless telegraphy.
27. Present and future development of electric heating.
28. Comparative study of the direct and indirect methods of taxing electricity in different countries.
29. Government regulations in reference to the electric transmission of power.
30. Distribution of electric power for agricultural purposes.
31. The various systems of multiple telegraphy.

Electric Lamp Breakages.—The question of the breakage in transit of metallic-filament lamps was raised at the annual conference of the Ironmongers' Federated Associations last week. The delegate from the Croydon Branch moved a resolution, the purport of which was to urge upon manufacturers of metallic-filament lamps the importance of increasing their discounts so that distributors might receive some compensation for losses incurred through breakages. One speaker went on to point out that through accident and a certain amount of carelessness on the part of assistants, a percentage of lamps were broken, and the present discount of 20 per cent. allowed only a very small net profit. Some time ago, he added, his association approached five firms in order to ascertain their views in regard to the matter, and only one of these firms, the Imperial Lamp Works (Brimsdown), Ltd., expressed their willingness to accede to the request of the association. It was understood that the Brimsdown Co. had increased their discount to 25 per cent. as from March 1st. The conference unanimously passed the resolution without much comment. The question of the stocking of metallic-filament lamps has sorely vexed such retailers as hardwaremen, whose losses through breakage are not confined to electric lamps, but cover such fragile goods as globes, chimneys, glassware and the like. But it is open to doubt whether by merely increasing the discount, manufacturers will remove the cause of complaint. As a matter of fact, the Ironmongers' Federation has on previous occasions brought pressure to bear upon manufacturers of other fragile goods, such as find their way into the jumble of a hardware store, and it has succeeded in obtaining a general increase in the discounts on certain lines. But individual dealers are still dissatisfied with that system of compensating breakages, and only suffer it because no more satisfactory one has obtained general acceptance. There is, however, one plan which we understand has been successfully tried by a manufacturer of glassware, and we would recommend it to the consideration of the henpecked maker of electric lamps who is worried to increase his discounts, but who hesitates to do so, lest such a course might be followed by a general slaughter of prices. That plan is simply to insure the lamps against breakage or damage. In the case where this has been tried the manufacturers find that the small premiums paid are saved many times over by the avoidance of a constant stream of petty claims and the necessity for investigations. The insurance company usually meets the small claims promptly, and only makes investigations when the claim is a large one, or when it has reason to suspect the genuineness of the claim.

The Electrical Benevolent Dinner.—We learn from the secretary that the Rt. Hon. Lord Justice Fletcher Moulton, C.B., will preside at the festival dinner of the Electrical Trades Benevolent Institution, to be held at the Hotel Cecil on Wednesday, April 26th.

The annual meeting of this Institution was held at the Hotel Cecil on Wednesday last, Mr. H. Hirst presiding. The report and accounts were adopted, and a resolution was passed altering one of the rules in such a way as to define more clearly the classes of men whom it is the object of the Fund to assist. We shall refer to this matter in our next issue.

Legal.—According to a *Times* report, the matter of British Thomson-Houston Co. *v.* Thomas L. Scott & Co. came before Mr. Justice Swinfen Eady on March 24th, when an interim injunction was granted restraining the defendants from using the word "Marsa," or any colourable imitation of it, in connection with the sale of electric lamps. "The plaintiffs considered the word to bear too strong a resemblance to their registered trade name 'Mazda,' and the defendants, who did not appear, had entered into an agreement, which they were stated to have broken, not to use it."

Faraday House.—We are informed that the annual dinner of the Faraday House Old Students' Association will be held at the Holborn Restaurant, London, W.C., on Wednesday, April 26th, at 7 for 7.30 p.m. The president for the year—Mr. H. H. Perry, of the North Metropolitan Electric Power Supply Co.—will be in the chair. All Faradians who wish to be present are asked to communicate with the honorary secretary, Faraday House.

Tantalum Athletic Club.—An interesting football match between Dalston and Thames Street resulted in a win by the former by 7 goals to love, last Saturday at Bailey's Lane, Stamford Hill. Caxton House will be entertained at Bailey's Lane next Saturday.

Industrial Finance: An Electrical Discussion in London.—We are asked to state that the National Electrical Manufacturers' Association (Incorporated), which was responsible for last year's Caxton Hall debate on Free Trade and Protection, has now made arrangements for a meeting, to be held on Tuesday, April 25th next, at 8 p.m., when a paper will be read upon "Foreign Compared with Home Industrial Finance," by Mr. L. Joseph. This meeting will probably take place at the Institution of Electrical Engineers. We understand that Mr. Joseph has made this subject his special study, and has the great advantage of being connected with the banking interest as well as having had experience in financial journalism. He has studied the question more particularly in the United States and Germany, as well as in other countries on the Continent. It is, therefore, thought that the electrical world may be able to learn a great deal from him.

The Association of Engineers-in-Charge Annual Dinner.—The annual dinner of this Association was held on March 25th, in the King's Hall of the Holborn Restaurant, Capt. H. Riall Sankey, R.E. (ret.), President of the Association, in the chair, supported by Judge Rentoul, Mr. H. Percy Boulnois, the Dean of London, and, in the absence of Mr. Marconi, Mr. Godfrey Isaacs, who told his audience that before long the rate of 7s. 6d. per word for cable telegrams would become 1s. for Marconi telegrams. After the customary loyal and patriotic toasts, that of "The Association" was proposed by Judge Rentoul, who, with a humour that would have obtained him an encore had he stood on the opposite platform to table A, referred to various matters of interest to the Association. He thought a judge had a better time than an engineer, for he did not have to work under a committee, and evidently the learned judge's opinion of the committees of public bodies tallies with that of most people. The President responded. Mr. Godfrey Isaacs responded on behalf of Mr.

Marconi to the toast of "Scientific Progress," proposed by Mr. Patchell. Rear-Admiral Corner responded for "Our Brethren Afloat,' which was proposed by Prof. Hele-Shaw, and told how he once asked the anxious mother of an aspirant to boilermaking fame where her son had served his time. She replied: "He never did serve any time; he was acquitted." In responding to "Our Guests and Friends," proposed by Mr. Clifford Smith, Mr. H. P. Boulnois, who is about to retire, told his audience he did not mean to be idle but would enter private practice. All will join in wishing him success. We hope the Local Government Board will find as good a successor for, of all departments, it is one which requires honest internal administration. Mr. Penn proposed the toast of "The President," and with him we may congratulate the Association on having for its President an engineer who rules his professional conduct as a gentleman should do. The programme of the evening was lightened by song and music by Miss Rosa Dallow, Miss Clair Blanche, Messrs. Will Edwards, F. Dalton, G. Hardey, and McCall Chambers.

Will.—Mr. J. R. Salter, of Park Hill, Worsley, near Manchester, general manager of the Lancashire United Tramways Co.'s undertaking, who died on December 16th last, left £2,262, with £1,864 net personalty.

Institution and Lecture Notes.—Institution of Electrical Engineers (Birmingham Local Section).—The Committee proposes Mr. M. Railing as chairman for the Session 1911-12, and Messrs. M. Solomon and J. J. Steinitz as new members of the Committee, Messrs. J. F. Lister and J. P. Kemp, who have served for three years, being ineligible under the rules for re-election. Additional nominations are invited by April 19th.

Institution of Electrical Engineers (Dublin Local Section).—On March 18th a conversazione and reception by the chairman, Mr. W. Tatlow, took place, and proved very successful and enjoyable.

Appointments Vacant.—Junior shift engineer, for the Borough Electricity Department, Wednesbury (30s.); switchboard attendant, for the Corporation Electricity Works, Paisley (20s.); assistant engineer, for the Walsall Corporation Electricity Department (£300); meter tester and fixer for the Rochdale Corporation Electricity Department (20s.). See our advertisement pages, &c.

N.E.L.A. Methods.—The following notice was recently sent us from Chicago by a correspondent:—

December 20th, 1910.

Special Mid-Winter Clinic!

To-night at 8 o'clock sharp.

Same old place.

Surreptitious session of celebrated subterranean sharps.

And others.

Dr. Roper on the Rostrum.

Vermiform appendix of underground system extirpated without pain, knife or anæsthetic. Operation described and illustrated for the first time in this country.

Incidental barber shop cadenzas by Edison Quartet.

And then (mum's the word!)

A Secret Conclave (all Press representatives excluded) at which a communication of the most profound importance will be confidentially presented to our members.

Come Early.

Boosting Committee.

The meaning of this mysterious communication, interpreted, was simply that an extra meeting of the National Electric Light Association was to be held, to hear and discuss a paper by Mr. D. W. Roper on the testing and repairing of underground mains, with music during an interval. Smoking was permitted during the whole of the proceedings, and the meeting was packed. This branch of the N.E.L.A. has 700 members, nearly all drawn from the Commonwealth Co.'s staff. The company is erecting a power station to contain six 20,000-kw. turbo sets.

Overland Central Stations.—The question of overland central stations in Germany has raised matters of varying interest in different parts of the country. The Brandenburg provincial diet, after having made an inquiry throughout the province as to the desire for the establishment of overland stations, has just resolved to take no further steps in support of the erection of such stations. On the other hand, the provincial committee of the province of Pomerania has decided to place £100,000 at disposal for an overland station for Rugen-Neuvorpommern to be built at Stratsund. The committee also proposes to recommend the next provincial diet to sanction a further sum of £225,000 for overland stations. A further matter relates to Bavaria, where there is already in existence a number of small electricity works. The representatives of these works, whilst not objecting to overland stations in general, are of opinion that the Bavarian State officials unduly favour the latter class and prevent the small works from concluding new contracts for the supply of current. A resolution of protest has been passed at a meeting held at Nuremberg, and this is to be presented to the Minister-President by a deputation of the works. The question of monopoly in materials is also acute in Bavaria. It appears that one overland station company, which was induced by the Home Ministry to give up the monopoly in installations, has sought to secure compensation by imposing a charge upon installation contractors for the right of carrying out works for prospective consumers in connection with supply from the station. This has led to an increase in the price of motors and installation work, although the Government has now been prevailed upon to intervene so as to obtain open competition for the contractors, and at the same time protect the interests of consumers.

Inquiry.—A correspondent wants names of makers of small low-voltage motors taking about 10 watts D.C.

Electrostatic Shocks.—The *Elektrotechnische Anzeiger* records a singular instance of the influence of railway engines on telegraph lines. It occurred in the course of the laying of a new telegraph line on a stretch of railway between Natal and the Transvaal, when the workmen had the unpleasant experience of receiving heavy shocks when there was no current passing through the lines. At first the occurrence was wholly inexplicable. Later it was noticed that the shocks were strongest when a train passed over the track; the workmen, after this, stopped work until the train was out of sight. The solution of the riddle was found in the fact that when the engine in motion emitted a quantity of steam an electrification of the neighbourhood was produced which occasioned an increase of the electric potential of the telegraph wires, producing the shock received by the workmen in contact with the earth. The experiments made to confirm this were so carefully carried out as to leave no doubt as to the fact, and the question only remained why such occurrences are not more frequently reported. Probably the quality of the air plays a part in such cases, and the air being unusually clear and dry on the high plateaus of the Transvaal, the strong winds which frequently blow there may have assisted in the production of the frictional electricity observed.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—By 20 votes to 14 the Chester T.C. has rejected a motion to rescind the resolution recently passed, increasing the salary of the electrical engineer (Mr. Britten) from £500 to £600 by annual increments of £20.

On the occasion of his departure for British Columbia, Mr. John McMillan, electrical engineer, Falkirk, was entertained at a complimentary dinner by members of the Town Council and friends. In the course of the evening Mr. McMillan was presented with a number of travelling requisites. In making the presentation, Provost Bogle said Mr. McMillan had proved himself an able public official and he had conducted their electrical undertaking wisely and well, so that it compared very favourably with any other in the country. He was a man of greater ability than they required to fill the position in Falkirk, and he hoped he would meet with his just reward in the land beyond the seas. Mr. McMillan suitably replied.

The Carlisle T.C. has decided to increase the salary of the electrical engineer (Mr. Allen) by £50 per annum as from April 1st, with increments of £20 a year to a maximum of £450; and that of Mr. J. H. Thompson, principal assistant to Mr. Allen, from £145 to £170, and has appointed Mr. A. W. Barham, charge engineer, as station superintendent.

Mr. Dominique Charles Redfern, of Manchester, has been appointed by the Stoke-on-Trent Corporation Electricity Committee, mains superintendent at the Stoke works.

At the offices of the Sheffield Corporation Electric Supply Department on Wednesday, a presentation was made to Mr. A. J. Cridge, who is leaving the service of the Corporation to occupy an important position with an electrical manufacturing firm in London. Mr. Cridge has occupied the position of superintendent of the Meter and General Testing Department for the past 10½ years. The presentation took the form of a gold watch guard, which was subscribed to by the whole of the staff and workmen of the electric supply undertaking. Mr. Fedden, the general manager, in making the presentation, spoke in eulogistic terms of Mr. Cridge's services, and referred to the enormous growth of the undertaking since Mr. Cridge joined the department. Mr. Cridge, who suitably replied, has the best wishes of the Electrical Review for success in his new sphere.

Tramway Officials.—According to a Cape Town paper, Mr. Alfred Giles, late general manager of the Cape Electric Tramways Co., Ltd., recently left there for England *en route* for Lisbon, where, as already stated here, he will take control of the electric tramway system. Before his departure, the members of the Automobile Club, of which he had been a prominent member, entertained him at a farewell dinner. The employés of the tramway company presented Mr. Giles with a gold watch and a case of pipes, a pair of silver salt cellars for Mrs. Giles, and a gold watch for Miss Giles. Mr. MacDonald, the traffic superintendent, made the presentation, and appropriate speeches were delivered by Mr. Keen, power and rolling stock superintendent; Mr. Jackson, senior road motorman; and Mr. Smith, secretary to the company. Mr. Giles is succeeded at Cape Town by Mr. Barkley, late of Port Elizabeth. At a farewell luncheon, Sir Frederick Smith, the Mayor of Cape Town, presided, and the proceedings were enthusiastic; praises of Mr. Giles's good work and sterling qualities being general.

The Southampton T.C. has increased the salary of Mr. C. G. Simpson, tramway traffic superintendent, from £200 to £220 a year, with an annual increment of £10 to a maximum of £250.

General.—Mr. W. G. Bond, who has been connected, since 1899, with the British Electric Traction Co., has taken over the general managership of the Traction and Power Undertaking operated by the Birmingham and Midland Tramways Joint Committee.

Mr. Charles P. Hainsworth, who was formerly in the electricity department of the Bradford Corporation, has just been appointed assistant manager of the Scottish National Exhibition at Glasgow. Upon the occasion of the Bradford Exhibition in 1904, Mr. Hainsworth was assistant to Mr. W. H. Knight, the manager.

Mr. John W. F. Warren, chairman of Messrs. Warren, Beattie and Co., Ltd., electrical engineers, of Lower Commercial Street, Middlesbrough, is leaving to take up an appointment in Constantinople for a British firm of manufacturers of electrical machinery.

Mr. Sydney N. Warren, a director of the same firm, has joined Messrs. Hanson, Brown & Co., Ltd., of Middlesbrough, and will take charge of their mechanical and electrical engineering department.

Mr. M. J. Williams Ellis, consulting engineer to the Buxton Lime Firm's Co., is leaving to-morrow for South Africa, on an extended tour in connection with electical and general mining matters, and, we understand, will be staying at the Carlton Hotel, Johannesburg.

On the occasion of the appointment of Mr. W. Buchanan, B.Sc., M.I.E.E., Senior Lecturer at Faraday House, to the Professorship of Electro-Technology in the Royal School of Mines, Transvaal University, his old pupils presented him with a pocket aneroid barometer. The presentation was made last Friday by Mr. F. de Latour, foreman student, who expressed the regret of the students at losing such a popular teacher and wished him every success in his new sphere. Mr. Buchanan, in expressing his regret at leaving so many friends, said that he looked forward to meeting some of them in the future, as great engineering developments would shortly be taking place in South Africa.

The Bessemer gold medal of the Iron and Steel Institute will, this year, be awarded to Prof. Henri le Chatelier, the eminent French metallurgist.

Obituary—Mr. H. G. Young.—We regret to record the death, which occurred last week in Chalmers' Hospital, Edinburgh, of Mr. Harry George Young, the engineer and manager of the Bo'ness Electricity Works. Mr. Young, who was only 28 years of age, was for some years in the service of the National Electric Construction Co., Ltd., and he acted for a time as superintendent of their Musselburgh power station, subsequently taking the position of tramways assistant manager, and later filling the post which he occupied at Bo'ness at the time of his death.

Mr. J. Hardie McLean.—We learn with deep regret of the death, which occurred on Monday last, of Mr. J. Hardie McLean, M.I.E.E., general manager and engineer of the Midland Electric Corporation for Power Distribution, Ltd., of Birmingham. Mr. McLean had been connected with this company for many years, and it must have been a considerable satisfaction to him to see his assiduous efforts for its success being rewarded by a recent satisfactory improvement in its affairs. Prior to his identification with this undertaking, as many of our readers may remember, the deceased gentleman was a partner in the firm of Messrs. W. Lucy and Co., engineers, of Oxford, while a number of earlier years of his career were spent with the Oxford Electric Co., Ltd. He served his apprenticeship at Belfast with Mr. Greenhill, afterwards becoming associated with Mr. Ferranti's staff at the Grosvenor Gallery and Deptford stations, whence he went to Oxford. Mr. McLean, who was only 44 years of age, passed away at Bournemouth, where he had gone a fortnight ago owing to ill-health. The cause of death was kidney trouble, which affected the heart, bringing on a sudden and unexpected termination. The body will be cremated privately, as desired by the deceased gentleman, at Perry Bar to-day (Friday).

NEW COMPANIES REGISTERED.

Economic Electric Co., Ltd. (114,790).—This company was registered on March 20th, with a capital of £2,000 in £1 shares, to take over the business of a dealer in electrical appliances of all kinds, manufacturers of electrical plant and machinery, manufacturers' agent and electrical engineer carried on by S. Brownlee, at Central Chambers, 17A, South Castle Street, Liverpool, as the Economic Electric Co. The subscribers (with one share each) are:—S. Brownlee, 17A, South Castle Street, Liverpool, merchant: R. Carter, 37, Bankburn Road, Tuebrook, Liverpool, electrical engineer. Private company. S. Brownlee is permanent governing director, subject to holding £500 shares, with £150 per annum as remuneration. Registered office, 17A, South Castle Street, Liverpool.

Trowbridge Electric Supply Co., Ltd. (114,745).—This company was registered on March 16th, with a capital of £4,000 in 2,000 ordinary shares of £1 each and 400 pref. shares of £5 each, to carry on the business of an electric lighting and power company in all its branches. The subscribers (with 100 shares each) are:—J. H. Edwards, 127, Victoria Street, Bristol, electrical engineer; S. Williams, Bristol, solicitor. Private company. The directors are to number not less than three or more than five; J. H. Edwards is the first managing director; qualification (except first directors), 50 ordinary shares. Registered by Seymour Williams & Co., 38, Parliament Street, S.W.

Grant & Blake, Ltd. (114,902).—This company was registered on March 25th, with a capital of £1,500 in £1 shares (1,498 6 per cent. cumulative preference and participating and two deferred), to carry on the business of electricians, electrical and mechanical engineers, dynamo and motor manufacturers, &c., to acquire the business carried on by E. N. F. Grant and G. F. M. Blake, at 41, St. John's Road, Clapham Junction, S.W., as Grant and Blake. The subscribers (with one deferred share each) are:—E. N. F. Grant, 41, St. John's Road, Clapham Junction, S.W., electrical engineer; G. F. M. Blake, 41, St. John's Road, Clapham Junction, S.W., electrical engineer. Private company. E. N. F. Grant and G. F. M. Blake are first managing directors with £2 10s. each per week as remuneration. Registered office, 41, St. John's Road, Clapham Junction, S.W.

R.E.T. Construction Co., Ltd. (114,847).—This company was registered on March 22nd, with a capital of £52,500 in 50,000 preference shares of £1 each and 50,000 deferred shares of 1s. each, to carry on the business of engineers, electricians, manufacturers of rolling stock, &c., and to adopt agreements (1) with the Railless Electric Traction Co., Ltd., and the Railways and General Development Co., Ltd., and (2) with the last-named company. The subscribers (with one share each) are:—F. W. Smyth, 20, Eastcheap, E.C., civil engineer; H. H. Bathurst, 56, Moorgate Street, E.C., secretary; A. Balding, 7, Alsen Road, Islington, N., book-keeper; J. P. Eyland, 97, Strathyre Avenue, Norbury, S.W., cashier; W. C. Stroud, The Briars, Chelmsford Road, South Woodford, clerk; A. P. Knight, 67, Ollerton Road, New Southgate, N., clerk; W. E. Bowley, 73, Pearson Street, Kingsland, N., clerk. Minimum cash subscription, 100 preference shares. The number of directors is not to be less than two or more than seven; the subscribers are to appoint the first; remuneration as fixed by the company. Registered office, 56, Moorgate Street, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Bombay Electric Supply and Tramways Co., Ltd. (85,055).—Particulars of a series of debentures, created by resolutions of May 11th, 1909, and February 14th, 1911, to secure half the amount of the subscribed capital for the time being, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £50,000. Property charged: Concession from Municipality of Bombay, electric licence, electric traction licence, and any other assets, present and future. Trustees: Electric and General Investment Co., Ltd.

India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd. (1,123c).—Return dated January 3rd, filed January 31st, 1911. Capital, £812,000 in £10 shares (50,000 ordinary, 25,000 preference and 6,200 unissued). 50,000 ordinary and 25,000 preference shares taken up. £750,000 paid. Mortgages and charges: £400,000.

Rio de Janeiro Suburban Tramways, Ltd. (110,272).—Particulars of £350,000 debentures, created by resolutions of January 31st and February 14th, and secured by trust deed dated March 1st, 1911, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £325,000. Property charged: The undertaking and certain tramways in the suburbs of Rio de Janeiro. Trustees: H. Knudson and M. le Comte Ludovic de Mieulle, both of Paris. The debentures are redeemable at 6 per cent. premium.

Cowper-Coles Inventions Development Co., Ltd. (65,755).—Return dated December 31st, 1910, filed March 7th, 1911. Capital, £50,000 in £1 shares (25,000 "A," and 25,000 "B"). 1,582 "A" and 10,000 "B" shares taken up. £1 per share called up on 1,582 "A." £1,582 paid. £10,000 considered as paid on 10,000 "B." Mortgages and charges. £190 debentures.

Dartmoor Electric Supply Co., Ltd. (110,871).—Particulars of £1,200 debentures, created February 18th, 1911, filed pursuant to Sec. 93 (3) of the Companies (Consolidation) Act, 1908, the amount of the present issue being £500. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Electrical Contracts and Maintenance Co., Ltd. (101,757).—Issue on February 27th, 1911, of £150 debentures, part of a series of which particulars have already been filed.

Stratford-on-Avon Electricity Co., Ltd. (86,502).—Particulars of £3,000 second debentures, created by resolutions of November 4th, 1910, and January 3rd, 1911, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital (subject to a £3,000 first mortgage debenture). No trustees.

Llangollen and District Electric Light and Power Co., Ltd. (75,384).—Debenture dated March 15th, 1911, to secure £300, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: P. H. Minshull, Oswestry.

Londonderry-Moville Electric Railway Syndicate, Ltd. (75,455).—Return dated January 14th, 1911. Capital £10,000 in £1 shares. 6,507 shares taken up. £1 per share called up on 1,507. £1,425 5s. paid, leaving £81 15s. in arrears. Mortgages and charges: Nil.

Kent Electric Power Syndicate, Ltd. (72,742). — Return dated January 5th, filed January 16th, 1911. Capital £15,030 in 1,500 ordinary shares of £10 each and 600 deferred shares of 1s. each. All shares taken up. £15,021 14s. paid, leaving £8 6s. in arrears. Mortgages and charges: £1,038.

Ashwell & Nesbit, Ltd. (54,631).—Particulars of £5,000 second debentures, created March 15th, 1911, filed pursuant to Sec. 93 (3) of the Companies (Consolidation) Act, 1908, the amount of the present issue being £2,500. Property charged: The company's undertaking and property, present and future, including uncalled capital, subject to first debentures. No trustees.

Llanelly and District Electric Lighting and Traction Co., Ltd. (64,341).—Charge for tramways construction, dated March 22nd, 1911, to secure not more than £25,000, charged on the company's undertaking and property, including uncalled capital. Holders: Metropolitan Bank (of England and Wales), Ltd.

Van Raden & Co., Ltd. (78,383).—Return dated January 13th, filed January 18th, 1911. Capital £10,000 in £1 shares. 6,754 shares taken up. £1 per share called up on 4,654. £4,654 paid. £2,100 considered as paid on 2,100 shares. Mortgages and charges: £4,600.

Engineering Instruments, Ltd. (66,427).—Return dated December 30th, 1910, filed December 28th, 1910. Capital, £31,562 10s. in 10,000 5 per cent. cumulative preference shares of £1 each, and 172,500 ordinary shares of 2s. 6d. each; 4,250 preference and 72,500 ordinary shares taken up. £1 (query, 15s.?) per share called up on 4,250 preference, and 2s. 6d. per share on 72,500 ordinary. £12,250 paid. Mortgages and charges: £3,100.

English Electrical Co., Ltd. (112,639).—Particulars of £3,500 debentures, created February 13th, 1911, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £1,000. Property charged: The company's property, present and future, including uncalled capital (subject to £3,500 prior debentures). No trustees.

Collieries Electric Power Development Syndicate, Ltd. (90,729).—Return dated January 13th, filed January 27th, 1911. Capital £9,000 in £1 shares. 6,007 shares taken up. £1 per share called up on 4,000 £3,375 paid, leaving £625 in arrears. £2,000 considered as paid on 2,000 shares. Mortgages and charges: Nil.

Accumulator Industries, Ltd. (67,180).—Return dated January 14th, filed January 21st, 1911. Capital £40,000 in £1 shares. 37,006 shares taken up. £1 per share called up on 26,506. £26,484 paid, leaving £22 in arrears. £10,500 considered as paid on the remainder. Mortgages and charges: Nil.

Durham Collieries Electric Power Co., Ltd. (83,421).—Amended particulars of £200,000 debentures, created by resolutions of February 19th, 1906, and December 21st, 1908, and secured by trust deeds dated March 18th, 1906, and February 12th, 1909, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of present issue being £43,280. Original particulars gave present issue as £50,000.

Torquay Tramways Co., Ltd. (96,012).—Particulars of £60,000 prior lien debentures, created February 21st, and secured by trust deed dated March 8th, 1911, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908. Nil issued. Property charged: The company's undertaking and property, present and future, including uncalled capital, and certain lands and buildings in parish of St. Marychurch, Devon. Trustees: F. T. Bulteel, Naval Bank, Plymouth, and J. C. Saunders, Milton Heath, Dorking.

CITY NOTES.

Durham Collieries Electric Power Co., Ltd.

THE directors' report for the year ended September 30th, 1910, states that the trading account shows a profit of £4,286, but after charging head office expenses, cable rentals, fees of trustees for debenture-holders, and rent and royalty to the Sunderland District Electric Tramways, Ltd., this profit is reduced to £854. Against this amount must be debited the charge for prior lien bond and debenture interest for the year under review, with the result that the slight profit is turned into a loss of £9,328. Despite the very heavy set-back occasioned by the miners' strike in the beginning of 1910, the results of which were felt during several months, the sales of current during the period show a substantial improvement. A new contract, which came into operation in November, 1909, has considerably increased the output, and it is anticipated that a further increase will be made in the forthcoming year. With a view to improving the conditions of the supply now being made under the various agreements with the company, the improvement of the load factor and the consequent more economical working of the power station under the agreement with the Newcastle-upon-Tyne Electric Supply Co., Ltd., the directors decided to ask an independent electrical engineer to proceed to Newcastle and report fully upon the matter. In order to comply with the provisions of the Companies' Act, the meeting will be held before the above-mentioned report is received, but it is the intention of the directors to communicate the purport of the report to the shareholders.

MR. A. W. TAIT (chairman) presided on Wednesday, March 22nd, at the offices, Basildon House, E.C., over the ordinary general meeting, and, in moving the adoption of the report, said the company was in the position that it had certain large consumers who were under contract to take power over a long term of years, and the whole of its affairs, so far as the generation and distribution of electricity, were undertaken by the Newcastle-on-Tyne Electric Supply Co. under an agreement for a long period of years. The effect of the trading for the year to September 30th was that the company made a trading profit of £4,286, and after charging head office expenses, cable rentals, fees of trustees for debenture-holders, and rent and royalty to the Sunderland District Electric Tramways, Ltd., this profit was reduced to £854: and if they debited the amount due for debenture interest—viz., the prior lien bond to the first mortgage debenture interest—the accounts showed a loss of £9,328. Manifestly that was an unsatisfactory state of affairs, and the directors had called in an independent electrical expert to consider the position, and go up to Newcastle to look into matters on the spot, with a view to giving the board a report, which, when received, would be circulated to the debenture-holders and the shareholders. The units sold during the year were 19,086,000, as against 17,264.000 units for the previous year, an increase of 1,822,000 units. The months of January and February of that year showed a still further increase, and if that was continued during the year, it would make the output for the year 1911 about 22½ million units, which would be an increase of 3½ million units over 1910. The kilowatts connected during the year were 728. The revenue for 1910 was, however, seriously affected by the miners' strike which took place in the middle of the year. They would remember that it lasted for a considerable time, and there were disturbances in the neighbourhood, and as a result some of the collieries were shut down for a period. The Sherburn Collieries, which were another group of the Lambton Collieries, were connected in 1909, but did not come on a full load till the middle of 1910, and the advantage of that would, therefore, be more clearly shown in the accounts for 1911. The Sunderland tramways, in which the company had an investment of 2,000 prior lien debentures, was at present being managed by a Receiver on behalf of the debenture-holders, and a scheme was being put forward in connection with the company under which the prior lien debentures would be repaid in cash. Prior lien bonds, which under the terms of the arrangement with the mortgage debenture-holders were to be reserved for improvements and extensions of the system had been issued to the extent of £31,900, and £27,900 of this had been issued as collateral security for loans by the Newcastle-on-Tyne Electric Supply Co. and other parties. These loans had been applied in paying for the cable extensions which had been carried out by the Newcastle company on their behalf and the terms of the loan were that the arrangement was to stand good until the termination of the period of the present arrangement with the first mortgage debenture-holders. The report from the Newcastle-on-Tyne Co. with regard to the operation of the system was that they had now practically localised the whole of the distributing system, and everything was in good order, so that in the case of any breakdown in one colliery there would be no disturbance in the supplies to others. The applications for fresh supplies at the end of the year amounted to 1,700 KW. The chief reason for that disappointing showing was, of course, the load-factor at the station. Under the arrangement they had with the Newcastle-on-Tyne Co. there was a considerable bonus on the cost of the electricity generated in the event of the load-factor, being over 42½ per cent., but he was sorry to say that during the greater part of the year the load-factor was under that figure. In 1910 also they had to pay additional for coal.

SIR DOUGLAS FOX seconded the motion, and the report was carried without discussion.

The retiring directors were re-elected, and the proceedings closed.

Evered & Co., Ltd.

THE directors report that the trading for the year 1910 has resulted, after the payment of £1,410 for debenture interest, in a net profit of £5,588, out of which they propose to pay a dividend of 2½ per cent. (free of tax), absorbing £4,269, and to carry forward £1,320. While the improvement in trade experienced during the earlier months was not fully maintained, there was a satisfactory increase in the year's turnover. The closing down of Barnet works, and the transference of the work previously carried on there to the company's works at Smethwick, have (in spite of the fact that Barnet works premises remain unlet) proved satisfactory; and the directors are of opinion that the company's work is considerably facilitated thereby. The directors have taken out a lease-redemption policy with the Sun Insurance Co., as, after careful consideration of the whole question of the values of the London and Birmingham premises, which are principally leasehold, but upon which the company has erected most of the existing buildings, they are of opinion that the interests of the company therein can be most safely and certainly dealt with in this way. All stocks have been taken at the lowest prices ruling on December 31st, 1910 which in all instances were at or below cost. The finished stock has been somewhat adversely affected by decrease in values, and a certain amount had to be scrapped (having become obsolete). The "profit and loss" account has been appreciably modified by this rigorous writing down and writing off. Plant has been revalued by Messrs. Alexander Smith & Son, of Birmingham, and the result confirms the company's figures. Machinery, plant and buildings have been maintained in thoroughly efficient order. The agreements under which the managing directors were appointed terminate on April 4th next, and will be submitted to the meeting for renewal for a further period of three years on the same terms. The agreements may be seen at the secretary's office.

South Wales Electrical Power Distribution Co.—The report, as printed in the *Financier*, states that as the whole of the expenses in connection with the working of the company's undertaking are now being borne by the Treforest Electrical Consumers Co., Ltd., there is at present no revenue account to be submitted. The steady progress made by the Treforest Co. referred to in the last report, has been fully maintained, as shown by the fact that the total units sold in 1910 was 1,715,226 in excess of those sold in 1909, and that since the month of July last it has not been necessary to make any levy on the consumers who are members of the Treforest Co. for extra charges beyond the Merz scale to cover the working expenses. In fact, the result of the year's working was to leave a small profit, after making provision for interest on the prior lien debenture stock, depreciation on new plant, and all other expenses connected with the working of the undertaking. Further, large and important consumers have been connected, and others are in course of being connected, to the mains, and, in order to meet this increasing demand, the Treforest Electrical Consumers Co., Ltd., have found it necessary to order a second large turbine set, which will shortly be delivered. The directors are, therefore, of opinion that the time has arrived when further capital should be provided for the development of the undertaking, and the share and debenture stockholders of this company are being invited to subscribe a proportion of the additional £50,000 which it is proposed to raise.

O. C. Hawkes, Ltd.—The directors report a net profit of £6,216, including the balance brought forward. An interim dividend of 5 per cent. per annum on the preference capital paid in July last absorbed £2,125, and after paying a similar amount to December 31st last the balance of £853 is carried forward.

Browett, Lindley & Co., Ltd.—After providing for interest on debenture stock and loans, writing off £5,104 for depreciation, and transferring £250 to investment reserve, the accounts for 1910 show (says the *Financial News*) a loss of £2,162, increasing the debit balance brought forward to £18,540.

Shawinigan Water and Power Co.—The directors have declared a quarterly dividend of 1¼ per cent., being at the rate of 5 per cent. per annum on the common stock.

Direct Spanish Telegraph Co., Ltd.

THE meeting of this company was held at Electra House, Finsbury Pavement, E.C., on Wednesday, March 22nd, the Marquess of Tweeddale, K.T., presiding.

The CHAIRMAN, in moving the adoption of the report (see ELECTRICAL REVIEW, page 440), said that the traffic receipts showed the substantial increase of £2,264, which was exceedingly satisfactory, in view of the fact that they were comparing with very good figures in 1909, which, again, were over £1,000 in excess of 1908. The continued improvement was due to increased commercial business over the Bilbao and Marseilles-Barcelona cables, and also, he thought, to the cordial relations existing between Great Britain and Spain. The working expenses showed a small decrease of £2, which was made up of small items of increase and decrease. Salaries at stations showed an increase of £18, which was the balance between the normal increases granted to the company's employés, added to an increase of £96 in the cost of guaranteeing the staff against fluctuations in the rate of exchange in Spain, and some economies in connection with changes in the company's staff. Repairs and maintenance showed an increase of £125, which was due to various repairs to the company's overhead lines at Bilbao, leading from the cable landing into the town, and to repairs to instruments, &c. During the year 1910 the Bilbao cable was interrupted three times, in all for 19 days, and the Marseilles-Barcelona cable once, for a period of three days. In every case the repairs were effected very rapidly, and the total cost, viz., £6,447, had been paid out of revenue. The reserve fund amounted to £60,861, but the company's securities showed a depreciation on December 31st last of a fraction over 13 per cent. The result of their operations during the year was, that after paying the interest on the first mortgage debentures and providing the necessary amount for their redemption, they were able to recommend a dividend of 4 per cent. on the ordinary shares, and to pay the usual 10 per cent. on the preference shares. The remaining balance of £4,048 had been transferred to the reserve fund. Owing to the general deterioration of their underground lines between Falmouth and the cable landing at Kennack Cove, in Cornwall (which had been in use since 1880), it had been found necessary to transfer their station from Falmouth to Kuggar, which was about ¼ mile from the landing place. This had necessitated the prolongation to Kennack of the overhead wire from London, which was leased by them from the General Post Office, this change having been considered more desirable than renewing the old underground system. The cost of these alterations would be charged to the accounts for 1911. He was pleased to be able to say that so far as the present year was advanced the traffic had been well maintained.

This resolution was seconded by SIR JOHN DENISON-PENDER, K.C.M.G., and carried unanimously.

Newmarket Electric Light Co., Ltd.—The annual meeting was held last week at Newmarket. Mr. G. H. Verrall presided, and moved the adoption of the report (ELECTRICAL REVIEW, page 486), which he said was a very satisfactory one, because though the introduction of metallic-filament lamps had largely decreased consumption, they were able to sell as much, or even more, current than ever before. When two-thirds of the year had gone he was doubtful whether they would be able to pay the 4 per cent. dividend, but the profit enabled them to do so. They had 21 new consumers and 1,545 new lamps had been connected. The engineer (Mr. F. A. Simpson) addressed the meeting, and said that electricity was now quite as cheap as any other illuminant, and no other light could compare with it as regarded cleanliness and convenience, or from the hygienic standpoint. All the doctors in the town had it in their houses; it was in use at the hospital, and wholly or partially at all the places of worship except one. During the last few years the company had installed 21 electric motors, ranging from ½ to 10 H.P. in the town. Every gas engine which had been fixed in Newmarket for making electric light had now been done away with, and electricity had been obtained from that company. The chairman stated later that but for one serious bad debt they would have been able to pay a larger dividend by ½ per cent. The report was adopted.

Stock Exchange Notices.—Applications have been made to the Committee to appoint a special settling day in—

Lobito Benguella and Catumbella Electric Light and Power Co., Ltd.—1,771 shares of £1 each, fully paid (Nos. 1 to 1,771); and £50,020 6 per cent. debenture stock, 1910.

To allow the following securities to be quoted in the Official List:—

Pachuca Light and Power Co.—£800,000 5 per cent. first mortgage 50-year bonds (Nos. A 1 to 7,000 of £100, and B 1 to 5,000 of £20 each).

Milford-on-Sea Electric Light Co., Ltd.—The directors in their annual report state that the progress made during the past year was satisfactory, and the amount of revenue showed an increase from £766 to £799. After charging all working expenses and placing £100 aside for depreciation of plant, there remained a net profit of £269, which had been carried to net revenue account. This had been charged with the interest on debentures, and with the balance brought forward from last year, there remained a sum of £217, out of which the directors recommended the payment of a dividend of 4 per cent. for the year on the ordinary shares, the balance to be carried forward.

British Aluminium Co., Ltd.

THE report for the year to December 31st, 1910, shows a profit, including interest and dividends on investments and the revenue derived from the Kinlochleven and Foyers Estates, of £125,063. The proportion of profit applicable to the period from January 1st to April 11th, 1910 (prior to the date of the incorporation of the company), is £34,606, leaving £90,457, which, with interest on deposits and transfer fees, amounting to £1,408, makes a total of £91,865. Interest on loans, depreciation of furniture and provision for income-tax, legal expenses and bad and doubtful debts, require £16,360; prior lien debenture interest, £21,196; directors' fees, £2,752; debenture stock service fund, £21,611; reserve for depreciation, £25,000; balance carried to reserve, £4,943. The scheme of reorganisation was duly passed at meetings of the debentureholders and shareholders of the old company, and the present company was incorporated on April 12th, 1910. In terms of the scheme, debenture stock and preference and ordinary shares have been allotted to the parties entitled thereto, the amounts due on the shares have been called up, and an issue of £800,000 5 per cent. prior lien debentures has also been made. The reserve account, at December 31st, 1910, stands as follows: Proportion of profits prior to date of incorporation not available for distribution, £34,606; less interest on loans applicable to that period, £6,819; leaving £27,787, which, with the amount added out of profits for period to December 31st, 1910, £4,943, makes £32,731. It is the intention of the directors to invest the reserve fund in securities outside the company's business. During the year under review, the company's works were not operated to their full capacity, although the output was greater than in any previous year. The demand for the metal is increasing satisfactorily, and it is expected that the output and sales for the current year will show an improvement on those of last year. The works at Kinlochleven have been completed during the year, and are now capable of full production. Further plant and machinery have also been installed, and new barracks and additional cottages have been added to the village. Owing to the increased demand for the metal, additions are being made to the alumina works at Larne, Ireland, and further plant has been installed at the rolling mills at Milton, Staffordshire. The assets of the Loch Leven Water and Electric Power Co. have been transferred to this company, with the exception of those required in connection with the electric lighting of the village and the pier and the wharves. These assets have been transferred to subsidiary companies in order that the Parliamentary rights with regard thereto may be properly administered. The electric railway from Martigny to Orsières, Switzerland, has been completed, and was opened for traffic on September 1st, 1910.

British Insulated and Helsby Cables, Ltd.

THE meeting of this company was held on Monday last week in Liverpool, Mr. James Taylor (vice-chairman) presiding, in the absence, through indisposition, of Dr. E. K. Muspratt, chairman.

The CHAIRMAN (according to a report of the meeting published in the *Chester Chronicle*) said the balance-sheet showed that the profit was £143,304, compared with £131,767 last year, an increase of £11,537, which, under all the circumstances, was satisfactory. Trade had been better than in the previous year, but, at the same time, in their principal line of business, heavy cables and mains, their trade did not increase at home, due principally to the fact that a comparative small amount of electric tramway, electric railway, and large lighting station work had been done, in connection with which heavy mains were always used. On the other hand, their foreign trade in these heavy cables and their accessories had been considerably increased, as well as the making of smaller wires and cables at their Helsby works, and the manufacture of telephone equipment at their Liverpool works, and it was from those sources principally that the extra profit had been made. Last year the chairman referred to the near approach of the transfer of the telephones in this country to the Government, and the fact that it would result in further business for their company. In anticipation of that transfer the Government had already placed large orders for their requirements. Profit and loss account showed that there was available for distribution a balance of £72,320, and the directors recommended a further dividend of 6s. per share, making, with the interim dividend already paid, a total distribution for the year of 10 per cent., leaving a balance to carry forward of £42,319, which was practically the same as last year. During the year they had spent £34,126 almost entirely on plant and machinery at the Prescot and Helsby works. For some time past the directors had realised the necessity for increasing the capital of the company, and after the most careful consideration they had decided to issue £200,000 of second mortgage debenture stock, on account of which £154,706 had been received up to December 31st, 1910. Most of the new departments which they have started of late years were doing good and satisfactory business.

The report was unanimously adopted.

Oriental Telephone and Electric Co., Ltd.—The directors will recommend at the annual meeting, on 24th prox. (subject to final audit), the payment of a dividend at the rate of 6 per cent. per annum on the preference shares for the half-year ended December 31st last, less income-tax, and a final dividend of 5 per cent. on the ordinary shares, free of income-tax, making a total of 8 per cent. for the year.

Capital Reduction.—*Horsfall Destructor Co., Ltd., and Red.*—A petition for confirming the reduction of capital from £100,000 to £50,521 is to be heard on April 4th.

Grand Berlin Tramways.

The report for 1910 of the Grosse Berliner Strassenbahn records a continuance during the year of the improvement in the economic conditions which commenced in the final months of 1909, and the consequential growth of traffic which took place. The number of passengers carried advanced from 396,620,000 in 1909 to 427,700,000 last year, and the gross receipts amounted to 8¼d. per car-mile. A short extension of the lines was constructed during the year, this raising the total length to 331 miles. The proportion of working expenses to gross receipts, which experienced a decline to 54·82 per cent. in 1909, rose again to 55·58 per cent. last year. The accounts show the following figures for the past two years :—

	1910.	1909.
Ordinary share capital	£5,004,000	£5,004,000
Bond capital	73,000	143,500
Gross profits	957,000	911,000
Depreciation provision	100,000	96,300
Renewal fund	141,000	138,000
Net profits	523,000	496,000
Municipal share in profits..	56,000	46,000
Dividend, per cent.	8½	8½

The rolling stock comprised 2,511 cars at the end of 1910, of which 1,492 were motor-cars and the remainder, with two exceptions, trailers. The number of employés rose from 10,231 in 1909 to 10,596 last year, of whom 1,183 were engaged on the allied suburban lines.

North German Submarine Cable Works.

The report for 1910 of the Norddeutsche Seekabelwerke A.G., of Nordenham, states that the year was chiefly devoted to the manufacture of the cables for the German South American Telegraph Co. After the shipment in February, 1910, by the cable steamer *Stephan* of the cable for the Teneriffe-Monrovia section for the company in question, the cable works began the construction of the gutta-percha portion for the Monrovia-Pernambuco section, and this was completed on December 20th, of a total length of 3,400 kilometres. The manufacture of the two cables Konakry-Monrovia-Grand-Bassam was commenced in the middle of November, and finished at the beginning of January. Various smaller orders were executed in the early part of 1910. In contradistinction to the other departments of the works, the gutta-percha factory was almost continually in operation on orders for worked-up gutta-percha for other than submarine cable purposes. Whilst the *Stephan* was employed from February, 1910, on the laying of the Teneriffe-Monrovia section and set out in January, 1911, for the laying of the coast sections and the section between Monrovia and Pernambuco, the cable steamer *Grossherzog von Oldenburg* was well employed in carrying out maintenance works, and also laid the Trieste-Pola-Spalato cable in September. The former steamer was in service for 107 days, and the latter for 135 days. After allocating £33,000 to depreciation in 1910 as compared with £34,000 in the previous year, the accounts show a net profit of £75,900 as against £68,100 in 1909. It is proposed to pay a dividend at the rate of 10 per cent. for 1910 on the share capital of £300,000, as in the previous year.

Houghton-le-Spring and District Electric Lighting Co., Ltd.

The directors' report for the two years ended December 31st, 1910, states that the working for the two years under review shows a total profit of £1,594. After deducting from this amount the sum of £1,275 in respect of the loss on working to December 31st, 1908, there is left a credit balance of £319. The sales of energy during the years 1909 and 1910 have been adversely affected by the miners' strike, which took place about the end of 1909.

The annual general meeting was held on Wednesday, March 22nd, at Basildon House, E.C., under the chairmanship of Mr. A. W. Tait, who said the company held the Parliamentary powers in a certain area, which was included in the total area supplied by the Durham County Electric Power Co. The units sold during the year under review were 4,115,000, against 5,320,000 in the previous year—a decrease of 204,000 units. The decrease was due to the coal miners' strike, which, in the case of one colliery alone, made a difference of 1¼ million units and £2,100 in revenue. The kilowatts connected during the year were 10, and the total kilowatts connected at the end of 1910 were 2,420. The number of consumers at the end of 1910 was 204, an increase of 28. The company had at last overcome the debit balance on previous years' trading, and at the end of 1910 there was a credit balance of £349. In the future the company ought, on even the present basis, to earn £800 or £1,000 a year.

Mr. T. O. Callender seconded the motion, and the report was adopted.

American Telephone and Telegraph Co.—The gross earnings for the year 1910, says the *Times*, were $35,358,328 : the net revenue, after payment of interest, was $26,855,893, and the balance, after payment of dividends, amounts to $6,079,071. The corresponding figures of the previous year were $32,761,000, $23,095,000 and $6,059,000.

Melbourne Tramway and Omnibus Co., Ltd.—The directors have declared a dividend of 4½ per cent. per share for the quarter to March 31st, equal to 15 per cent. per annum.

Folkestone Electricity Supply Co., Ltd.

The directors' report for the year ended December 31st, 1910, states that the company continues to make satisfactory progress. Up to December 31st, 1910, the equivalent of 118,049 8-c.p. lamps was being supplied, being an increase of the equivalent of 6,301 8-c.p. lamps. Including the receipts from hired installations the profit on revenue account for the three undertakings amounts to £15,383. This amount, with the sum of £341 brought forward, and interest and installation profits, and after allowing for interest on debenture stock, dividend on preference shares and bank charges, &c., shows a balance of £8,949. Out of this an interim dividend at the rate of 4 per cent. per annum has been paid on the ordinary shares, and the directors have carried the sum of £5,000 to the depreciation fund, making this fund now £19,253 net; the sum of £600 to the reserve fund, making this fund now £3,600; and they recommend the payment of a dividend at the rate of 8 per cent. per annum (less income-tax) on the ordinary shares for the half-year (making 6 per cent. for the year) which will require £2,000, thus leaving a balance of £349, which it is proposed to carry forward. The balance of the suspense account opened last year in respect of the purchase price of Mr. Payer's connection has been charged against this year's accounts. The directors' original intention as reported last year was to spread this balance over two years, but having regard to the highly satisfactory nature of this year's accounts they consider it better policy to write off the whole amount this year. There is a small amount of the company's 4½ per cent. debenture stock still unissued, viz., £2,175. This can be taken up by shareholders or stockholders of the company at par, and carries full interest from the date of payment.

Units generated..	1,797,200
Quantity sold—Public lamps	85,010
By contract..	409,084
Private consumers by meter	950,256
Total sold	1,444,350
Used on works	28,850
Total accounted for	1,473,200
Not accounted for	324,000
Public lamps—Arcs 88; Nernst and incandescent ..	449
Total maximum supply demanded, kw...	1,206

Guildford Electricity Supply Co., Ltd.

The report of the directors for the year ended December 31st, 1910, states that the company during the past year has again made very satisfactory progress, the gross receipts being £7,885, as compared with £7,490 for 1909, an increased revenue of £395. There is a balance on the revenue account of £3,445 (after crediting depreciation fund account with £1,000), as compared with a balance of £3,292 (after crediting depreciation fund account with a like amount) on the revenue account for 1909. After making due provision for debenture interest, dividend on preference shares, and the placing of £500 to the credit of reserve fund account, the net revenue account shows a balance of £1,071 for distribution. The directors recommend a dividend at the rate of 5 per cent., less tax, for the past year on the ordinary share capital of the company, which will absorb £700, thereby leaving a balance of £371 to be carried forward. An extension of the company's supply has been made to Shalford. A new battery has been installed of double the capacity of any previous ones erected. The directors have decided that the figure at which the old battery stood in the books, viz., £1,432, shall be written off this year out of the reserve fund account. The following table shows the progress of the business :—

Year.	Connections.	Total revenue.	Total costs.	Gross profit.
1908	661	£6,772	£2,604	£4,168
1909	744	7,490	3,198	4,292
1910	807	7,885	3,441	4,444

	1910.	1909
Units sold—Lighting	275,160	263,822
,, Power and heating	201,276	126,666
Total	476,436	390,488
H.P. of motors connected	469	986
Total connections	807	744

Liverpool District Lighting Co., Ltd.—The directors' report for 1910 states that the supply of electricity continues to show satisfactory progress, 1,684 lamps having been connected during the year. The total number of lamps supplied by the company on December 31st, 1910, was 29,679. The total quantity of electricity sold for the year was 376,525 units, compared with 368,825 for the year 1909. The new metal-filament lamps are still causing some reduction in the quantity of electricity consumed, there having been a slight falling-off in the sales during the March and December quarters. This has, however, been more than made up by the increase in power and other business obtained during the summer months. The installation and manufacturing business has again become profitable, there being a small balance to credit. The profit for the year, together with the balance brought forward from 1909 after payment of the final dividend for that year and the interest on debentures, leaves an available balance of £3,313. Out of this an interim dividend has been paid at the rate of 4 per cent. per annum, £20 written off the cost of fitting up the offices in Tithebarn Street, and £1,000 set aside for depreciation, leaving a balance of £1,165, out of which it is recommended that a dividend be declared for the half-year ended December 31st, 1910, at the rate of 4 per cent. per annum, less income-tax.

Rhondda Tramways Construction Syndicate, Ltd.

THE third ordinary general meeting was held on Thursday, last week, at Winchester House, E.C., Mr. L. B. Schlesinger in the chair.

The CHAIRMAN, in proposing the adoption of the report (see ELECTRICAL REVIEW, page 483), said the accounts were short and he thought they would consider them satisfactory. As it was their intention to liquidate the syndicate shortly, he would explain how the capital had been disposed of. The capital originally was £250,000. The original cost of construction was £227,000, the amount paid to the vendors in cash and shares was £9,000, and the preliminary expenses amounted to £3,563, which left a balance of £10,436. That balance, together with £3,539, had been spent on extra works, principally in doubling the lines at certain points where single track construction had been shown on the Parliamentary plans, and on other works for the benefit of the undertaking. That extra expenditure was the subject of an independent investigation and report by an outside engineer, Mr. Waller, of Kincaid, Waller, Manville & Dawson, one of the first experts on tramway works in this country, and it was satisfactory to know that a settlement was made with the contractors for an amount substantially below that which Mr. Waller recommended should be paid. He (Mr. Schlesinger) was chairman of the contracting company, and being also chairman of the syndicate he insisted upon independent advice, and then having received it, obtained a further reduction for the syndicate. That extra expenditure had been taken into account in the consideration finally agreed and received from the Rhondda Tramways Co. The profit for the year amounted to £15,454, and adding to that the balance brought forward (£2,650), they had a total of £18,105 16s. 1d. at their disposal. An interim dividend of 3 per cent., less tax, absorbing £7,062 10s. was paid last August, and out of the balance—£11,043 6s. 1d.—the directors recommended the payment of a further dividend of 3 per cent., making 6 per cent. for the year, and leaving £3,980 16s. 1d. to be carried forward. That would provide for the extra capital expenditure he had just referred to. Turning to the accounts of the Rhondda Tramways Co., the net profit, after meeting all running charges, the rent of £2,250 to the Rhondda Corporation, &c., amounted to £19,388, and that, with the approval of the directors, had been dealt with as shown in the report. A bonus of £220 7s. 10d., representing a week's wages, was paid to the staff and employés of the company—rather a new departure in tramway management, he believed. The Rhondda Tramways Co. paid a good rate of wages, which compared favourably with the rate paid by all the other tramway systems in this country, and the directors considered the rate the maximum; but, on the other hand, when men gave satisfaction, and the profits permitted it, they believed it was good policy to show the men that they were not forgotten. It did not mean much to the company when there was a substantial surplus available, but it meant a great deal to the men, and tended to make the relationship between the company and its employés more harmonious, and to induce them to put forth their best efforts on its behalf. The total receipts for the year, £51,565, compared with £49,864. The number of passengers carried was 9,112,000 odd, as compared with 8,800,000; the car-miles run were 1,094, as against 1,064; the average receipts per car-mile were 11·07d., compared with 11·24d., and the average receipts per passenger, 1·32d., as against 1·33d. The cost of current worked out at 1·004d. per unit, against ·94d. for the previous year—the increase being wholly due to the increased amount required for sinking fund premium and interest on the extra capital expenditure on the additional plant installed in the generating station. He thought they had every reason to congratulate themselves upon the results, especially when they considered the serious labour troubles which prevailed in the district, and which involved an enormous loss of wages to the miners. Notwithstanding the strike, the receipts showed an increase of £1,701—had no strike occurred it was their opinion and also that of the manager, that a much larger increase would have been shown. A decrease, therefore, of only £565 10s. in the net profits under such conditions was, he thought, ample proof of the strength of the tramway undertaking, and that it had every prospect of a profitable future before it. Up to last week there was every indication that the mine owners and the men would come to an understanding, but unfortunately there had again been riotous conflicts between the men and the police. When, however, a settlement was arrived at, he hoped it would be a permanent one. The capital of the tramways company had been re-arranged as follows:—£250,000 5 per cent. debentures, £100,000 6 per cent. cumulative preference shares, and £100,000 ordinary shares. Of this the syndicate was entitled to £200,000 debentures, £98,200 preference shares, and £50,000 ordinary shares. The balance of £50,000 ordinary shares would be held in reserve. The debentures were sold at 89, less commission, which they considered a good price considering the difficulty of financing electrical undertakings in this country. The public issue of these debentures was recently made. The syndicate was to receive payment as follows:—£50,000 on March 27th, £60,000 on May 8th, and £68,000 on July 8th: and as no doubt the shareholders would like to get the cash portion as quickly as possible, the directors would in the course of a day or two call a meeting of the syndicate for the purpose of considering, and, if approved, passing a resolution to wind up the syndicate so that the assets could be distributed at the earliest possible moment. It might be necessary for the liquidator to retain out of the cash to be received by the syndicate, about £38,000 to construct certain tramway extensions in the Rhondda Valley. They believed that those extensions would add considerably to the profits of the undertaking, and they wished to make the shares as valuable as possible. In addition, if they were called upon for such an advance they would make an additional profit out of the transaction. It might happen, however, that the Rhondda Tramways Co. would be able to arrange the finances without calling upon the syndicate, and he hoped that might turn out to be the case and so enable the whole of the cash to be distributed. It was, however, because they knew of the difficulty in getting money for tramway undertakings in this country, no matter how good the undertaking might be, that they proposed to adopt the course suggested. In addition to distributing the cash, the liquidator would in all probability allocate shares so that the shareholders might get their future dividends as shareholders of the tramway company.

MR. J. CARR SAUNDERS seconded the motion, which was adopted after a short discussion.

Bromley (Kent) Electric Light and Power Co., Ltd.

THE directors' report for the year 1910 states that the lamp connections have increased from 89,282 to 95,307. It is satisfactory to note that in spite of the introduction of metallic-filament lamps, the sale of current still shows a slight increase. The works have been maintained in good order and repair. The result of the year's trading, including £172 brought forward, shows a profit of £12,202, and after payment of debenture interest and trustees' fees, amounting to £3,172 and writing off one-third of the cost of a motor car purchased during the year, there is a balance of £8,949. An interim dividend at the rate of 4 per cent. per annum was paid for the half-year in October, and the directors recommend the payment of a further dividend for the second half-year at the rate of 8 per cent. per annum, making a total dividend of 6 per cent. for the year; that £1,068 be placed to reserve account for renewal of plant, and £3,195 to general reserve fund, leaving a balance of £185 to be carried forward.

Continental.—GERMANY.—The Berlin Electricity Works Co., which has a practical monopoly of electric light and power supply in the German capital, has just decided to make a fresh issue of capital in the form of £500,000 in 4½ per cent. bonds, thus raising the total bond capital to £2,900,000 on an ordinary share capital of £3,205,000. It is mentioned that the additional money is required for strengthening the working capital and for carrying out new schemes. At the same time the company announces its intention of taking over from the Imperial Continental Gas Association, shares of £94,800 in the Berlin Suburban Electricity Works and the latter's debt of £42,500. This financial transaction has the result of transferring the Suburban Works entirely to the Berlin Electricity Works Co. as the remainder of the former's ordinary capital is held by the Electric Supply Co. controlled by the latter. The operation represents a further step in the direction of securing a sufficient scope of business in the event of the municipalisation of the Berlin Electricity Works, and the same reason was the cause of the establishment, in 1908, of the close association between the former and the Electric Supply Co. According to the terms of the concession, it is possible for the Municipal Council to expropriate the works as from October 1st, 1915, but it is unknown whether the right will be exercised. It was, however, mentioned at the last meeting of the Berlin company that the directors did not believe that the city authorities would take over the undertaking owing to the large sum which would have to be paid as the purchase price.

The Gesellschaft für Electrische Unternehmungen, of Berlin, is declaring a dividend at the rate of 9 per cent. for the last financial year, as compared with only 8 per cent. for the preceding 12 months.

AUSTRIA.—The Nordbohmische Electricitäts Gesellschaft is the name of a new company which has just been formed with a capital of 1,500,000 crowns, under the auspices of the Bergmann Co., of Berlin, to establish electrical undertakings in Northern Bohemia.

SWITZERLAND.—La Société Suisse pour l'Industrie Electrique, of Basle, is declaring a dividend of 7 per cent. for the last financial year, the same as for the preceding 12 months.

For the last financial year the Société Suisse pour l'Industrie de l'Aluminium, of Neuhausen, is declaring a dividend of 14 per cent., as contrasted with 12 per cent. in the preceding 12 months.

ITALY.—La Société Elettricita Alta-Italia, of Turin, is declaring a dividend of 5½ per cent. for the last financial year, as compared with 5 per cent. in the preceding 12 months.

BELGIUM.—The balance-sheet of the Société Bruxelloise d'Electricité, of Brussels, for the last financial year, shows a profit of £4,519, as compared with only £2,089 in the preceding 12 months.

The report of the Société des Tramways Electriques de Gand, of Ghent, for the last financial year, shows a profit of only £6,886, as contrasted with £8,360 in the preceding 12 months.

Indian Electric Supply and Traction.—The report states (according to the *Financier*) that the year's working in Cawnpore produced a surplus of £4,935, compared with one of £1,742 in 1909. London expenditure, which includes £459, the cost of the debenture issue, amounted to £1,091, and interest to £2,372, leaving, with £1 10s. received for fees, a net surplus of £1,474 for the year. This has been applied in reduction of the balance at debit of profit and loss account, which is now reduced to £16,540.

Sir W. G. Armstrong, Whitworth & Co.—The directors have declared a dividend at the rate of 10 per cent. per annum, free of income-tax, on the ordinary shares for 1910, carrying forward £185,000.

MARKET QUOTATIONS.

Wednesday, March 29th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a ,, Nitric	,,	22/-	..
a ,, Oxalic	,,	28/-	..
a ,, Sulphuric	,,	5/6	..
a Ammoniac, Sal	,,	42/-	..
a Ammonia, Muriate (crystal)	per ton	£29	..
a ,, ,,	,,	£30	..
a Bleaching powder	,,	£5 10	..
a Bisulphide of Carbon	,,	£18	..
a Borax	,,	£16	..
a Ferro-Silicon (50 %)	,,	£12 10	..
a Copper Sulphate	,,	£21	..
a Lead, Nitrate	,,	£25	..
a ,, White Sugar	,,	£22 15	..
a ,, Peroxide	,,	£32	..
a Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, in casks	per lb.	8½d.	..
a Potash, Caustic (75/80 %)	per ton	£20	..
a ,, Chlorate	per lb.	8½d.	..
a ,, Perchlorate	,,	4½d.	..
a Potassium, Cyanide	,,	7d.	..
a Shellac	per cwt.	80/-	..
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers	,,	£6 10	..
a ,, Recovered	,,	£5 10	..
a ,, Lump	,,	£5	..
a Soda, Caustic (white 70 %)	,,	£11	..
a ,, Chlorate	per lb.	8½d.	..
a ,, Crystals	per ton	£8 5	..
a Sodium Bichromate, casks	per lb.	8d.	..
a ,, Cyanide (basis 100 %)	,,	7d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots	per ton	£75	..
b ,, Wire, in ton lots	,,	£102	..
b ,, Sheet, in ton lots	,,	£120	..
p Babbitt's metal ingots	,,	£98 to £115	..
c Brass (rolled metal 2° to 12° basis	per lb.	6½d.	..
c ,, Tube (brazed)	,,	8½d.	..
c ,, ,, (solid drawn)	,,	6¾d.	..
c ,, Wire, basis	,,	6¼d.	..
c Copper Tubes (brazed)	,,	8½d.	..
c ,, ,, (solid drawn	,,	8¼d.	..
g ,, Bars (best selected)	per ton	£70	..
g ,, Sheet	,,	£70	..
g ,, Rod	,,	£70	..
e ,, (Electrolytic) Bars	,,	£57 7 6	7/6 dec.
e ,, ,, Sheets	,,	£73 2 6	7/6 dec.
e ,, ,, Rod	,,	£60 12 6	17/6 dec.
e ,, ,, H.C. Wire	per lb.	7⅛d.	⅛d. dec.
f Ebonite Rod	,,	5/-	..
f ,, Sheet	,,	5/6	..
n German Silver Wire	,,	1/11	..
h Gutta-percha, fine	,,	8/6	..
h India-rubber, Para fine	,,	5/9	10d. dec.
l Iron Pig (Cleveland warrants)	per ton	47/7½	9d. dec.
l ,, Wire, galv. No. 8, P.O. qual.	,,	£14	..
g Lead, English Ingot	,,	£13 2 6 to £13 7 6	2/6 dec.
m Manganin Wire No. 28	per lb.	6/6	..
g Mercury	per bot.	£9 5	15/- dec.
d Mica (in original cases) small	per lb.	6d. to 1s.	..
d ,, ,, ,, medium	,,	2/6 to 4/-	..
d ,, ,, ,, large	,,	4/6 to 8/6	..
p Phosphor Bronze, plain castings	,,	11d.	..
p ,, ,, rolled bars & rods	,,	1/0½	..
p ,, ,, rolled strip & sheet	,,	1/1	..
o Platinum	per oz.	166/6	..
e Silicium Bronze Wire	per lb.	8⅝d.	⅛d. dec.
r Steel Magnet, in bars	per ton	£55	..
g Tin, Block (English)	,,	£187 to £188	£10 inc.
n ,, Wire, Nos. 1 to 16	per lb.	2/1	..
p White Anti-friction Metals	per ton	£45 to £150	..
k Zinc, Sh't (Vieille Montagne bnd.)	,,	£28	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d F. Wiggins & Sons.
e Frederick Smith & Co.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
l Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

Fairbairn Lawson Combe Barbour, Ltd.—For the year ended December 31st there is a profit, after charging all expenses incidental to the business (including depreciation, £15,910), of £93,823. After deducting directors' fees, management, office expenses, &c., less interest and transfer fees and debenture interest, there remains £75,475, making with the balance brought forward £136,768. The directors recommend (says the *Times*) a dividend at the rate of 10 per cent. per annum on the ordinary shares for the half-year to December 31st, making 7½ per cent. for the whole year, also a bonus of 5 per cent. on the ordinary shares, carrying forward £59,268.

Anglo-Argentine Tramways Co., Ltd.—The directors have declared a final dividend of 4¼ per cent. on the ordinary shares for the half-year to December 31st, less income-tax, making 7¾ per cent. for the year, after placing £110,000 to depreciation renewals funds, carrying forward a balance of £13,044.

A. Reyrolle & Co., Ltd.—The *Financier* reports that the profits for the past year were £6,328. A dividend of 7 per cent. is proposed, £374 being carried forward.

STOCKS AND SHARES.

Tuesday Evening.

HOME Railway issues are amongst the most active and interesting in the Stock Exchange markets, and the chief excitement centres around the group of Underground stocks. Other investment departments have been firm, the anticipation of an early fall in the Bank Rate being the chief contributor to hopes of a further advance in Consols and similar securities.

The determination to electrify practically the whole of the London, Brighton and South Coast system is the logical outcome of the success attendant upon the portion already translated. Apart from the importance of the present project, a wider prospect is opened out by the possibility of other trunk lines following the example of the Brighton, and the visionary dreams of the day when Great Britain shall be covered with a network of electric, instead of steam, railways.

To descend once more from the sublime to the Underground, Central Londons have further advanced appreciably, and the Ordinary stock has risen 6 points within a fortnight. The true patriot delights in the "All-British Shopping Week" having been accompanied by very All British weather, and no doubt the wildness of the elements has sent traffic on to the Tubes. City and South Londons lost ½ from their big rise of a week ago. Districts were rushed up 2½ points to 32½, and Metropolitans gained 1 at 54, both, however, parting with some of the gain as profit-takers came along.

Two or three times attention has been directed here to Great Northern and City Preferred "A" shares as a useful gamble at about 17s. 6d. Last week the hint was reiterated, and the price has gone up within the last few days to 27s. 6d., business having been done at that price, so that those who acted upon the suggestion had no reason to be dissatisfied with their shrewdness.

After the rise in Home Railway stocks, there deserves to be noted a six-point jump up in British Columbia Electric Railway Deferred Ordinary stock. This ostensibly is due to the excellent figures published in the recent prospectus offering new 4½ per cent. Debenture stock. It seldom happens that a new issue tends to improve the value of existing securities, except in those cases where the latter receive a bonus from the new, but the British Columbia must be taken as an exception in proof of the rule. Anglo-Argentine Trams Preference shares of both classes are 1/16 higher, the report of the company, out the other day, being exceedingly good. Of the Home descriptions, British Electric Tractions have improved, and Underground Electric Railway 4½ per cents. and the Income bonds as well, gained a point apiece.

Electricity Supply shares are enjoying the simple life, untroubled by any particular alterations one way or the other. A few *ex* dividend markings have been made, and prices mostly reflect these deductions. South Metropolitan issues have improved. A mild feature is the strength of Urban Debenture stock. Edmundson's Debenture has gained a point, and the demand for the higher-class issues is quietly good. The manufacturing shares hold their improvements. Edison & Swan 4 per cent. Debenture stock has risen a further 2 per cent.

Canadian-Latin securities are steady, with rises predominating. Mexico is more in favour now, but there is some uncertainty in the minds of the underwriters of the Mexican Northern Power Company as to how the bonds will be taken by the public. The prospectus is on the eve of issue, and should be out at the end of this week. A great attraction is the offer of bonus Common stock to the applicants for the bonds.

There has been a lively gamble in the shares of the West India and Panama Telegraph Co. They were run up nearly half-a-sovereign, but this tempted the profit-takers, and the price fell back to 3, leaving a 5s. rise on the week. Anglo-American Telegraph Deferred stock attracted renewed attention, and the price sharply recovered, although it did not retain the full amount of its rise. The Preferred, however, is 1½ higher. Direct United States Cable shares are 5s. to the good, and Amazon Telegraphs gained 2s. 6d Reuters have been a good market.

National Telephones are somewhat out of favour, and the price of the Deferred went back a couple of points, while the Third Preferences are ⅛ easier. There is already a contention as to whether the 3½ per cent. Debenture stock is entitled or not to any premium upon its re-payment. Monte Video Ordinary shares are a shade better.

Cryselco Lamp Tests.—In connection with the tests recently carried out by the Westminster Electrical Testing Laboratory on tungsten lamps for 200 volts, we are informed that the Cryselco metallic-filament lamp, which is made at Bedford, headed the list, giving the best average results under all headings up to 1,250 hours.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years. 1907.	1908.	1909.	1910.	Closing Quotations March 21st.	Closing Quotations March 28th.	Business done week ended March 28th, 1911. Highest	Lowest.	Rise + or Fall —	Present Yield per cent. £ s. d.
300,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	..	6 — 6¼	6⅛ — 6⅜	6⅛	6⅞	+ ⅛	Nil.
$263,244,000	Do. 5 % Deb. Red. Iss. at 98 % script all paid	Stock	5 %	5 %	5 %	5 %	96½ — 98⅜	96⅜ — 98⅝	96⅜	..	..	5 1 6
$255,196,000	American Telephone & Telegraph, Cap Stock ..	$100	8 %	8 %	8 %	..	150 —152	148 —150 xd	150½	150	..	5 6 8
$53,000,000	Do. Collat. Trust, 4% Bonds, 1 to 28,000 and 53,001 to 78,000	$1000	4 %	4 %	4 %	4 %	93 — 95	93 — 95	94¼	94	..	4 4 8
545,920	Anglo-American Telegraph	Stock	3⅜%	£3 4s.	3⅜%	3⅜%	68½ — 70½	69 — 71	70⅛	68¾	+ ⅛	5 5 8
3,227,040	Do. do. do. 6 % Pref.	Stock	6 %	6 %	6 %	6 %	111½ —112½	113 —114	113⅞	111½	+1⅛	5 5 8
3,227,040	Do. do. do. Deferred	Stock	1 %	8/-	25/-	30/-	27 — 27½	27⅛ — 27⅜	27⅜	27⅛	+ ⅛	5 8 1
47,725	Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red.	100	5 %	5 %	5 %	5 %	100 —102	100 —102	..	..	..	4 18 0
44,000	Chili Telephone, Nos. 1 to 44,000	5	8 %	8 %	8 %	..	7 7/16 — 7 15/16	7 7/16 — 7 15/16	7 7/8	7 7/8	..	5 9 5
2,462,309	Commercial Cable, Stlng. 500 year 4% Deb. Sk. Red.	Stock	4 %	4 %	4 %	4 %	86½ — 88⅜	86 — 88 xd	87⅛	86¼	..	4 10 11
16,000	Cuba Telegraph	10	6 %	6 %	6 %	..	9½ — 10¼	9¼ — 10¼	..	..	..	5 9 1
6,000	Do. 10 % Pref.	10	10 %	10 %	10 %	..	17¼ — 18¼	17¼ — 18¼	..	..	..	5 9 7
12,931	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	4%	3⅜ — 4	3⅜ — 4 xd	..	..	..	5 0 6
6,000	Do. do. 10 % Cum. Pref. ..	5	10 %	10 %	10 %	10%	8½ — 9	8¼ — 8⅝ xd	..	..	..	5 14 3
30,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	4 8 3
60,710	Direct United States Cable	10	4½%	4½%	4 %	5 %	7½ — 8	7⅝ — 8⅛	8	7⅞	+ ⅛	6 1 3
32,500	Direct W. India Cable, 4½% Reg. Deb., 1 to 1,200, R.	100	4½%	4½%	4½%	4½%	99½ —101½	99⅛ —101⅝	..	..	..	4 8 8
4,000,000	Eastern Telegraph, Ord. Stock	Stock	7 %	7 %	7 %	..	135 —138	13⅞ —138	137⅛	135⅜	..	5 2 2
2,000,000	Do. 3½ % Pref. Stock..	100	3½%	3½%	3½%	3½%	83½ — 85½	84 — 86	86	84½	+ ⅛	4 1 5
1,896,706	Do. 4 % Mort. Deb. Stock Red. ..	Stock	4 %	4 %	4 %	4 %	100⅝ —102⅝	101¼ —103¼	103⅛	101⅜	+ ⅛	3 17 10
300,000	Eastern Extension, Australasia, and China Tele.	10	7 %	7 %	7 %	..	13½ — 13⅝	13⅝ — 13¾	13 15/16	13⅝	..	5 1 10
752,400	Do. 4 % Deb. Stock..	Stock	4 %	4 %	4 %	4 %	99⅛ —101⅛	99⅛ —101⅛	..	..	..	3 18 10
200,000‡	East. & S. Afric. Tel., 4 % Mt. Db. Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	4 %	100½ —102½	100½ —102½	..	..	..	3 18 1
181,127	Globe Telegraph and Trust	10	5⅝%	5⅝%	5⅞%	..	10½ — 11	10⅜ — 11 xd	10 13/16	10 9/16	..	5 4 4
181,127	Do. do. 6 % Pref...	10	6 %	6 %	6 %	..	13 — 13½	12⅞ — 13¼ xd	13 5/16	12 29/32	..	4 10 7
150,000	Great Northern Telegraph, of Copenhagen..	10	20 %	18 %	18 %	..	32 — 33	32 — 33	..	..	..	5 8 0
17,000	Indo-European Telegraph	25	13 %	13 %	13 %	..	58 — 60	58 — 60	..	..	..	5 8 4
$41,880,400	Mackay Companies Common	$100	4 %	4 %	4½%	5 %	93 — 96	93 — 96	..	..	..	5 4 2
$50,000,000	Do. do. 4% Cum. Pref.	$100	4 %	4 %	4 %	4 %	76 — 78	76 — 78	..	..	..	5 2 7
394,190	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	..	13/16 — 15/16	13/16 — 15/16	15/16	..	..	Nil
72,680	Monte Video Telephone Co., Ltd. Ord. ..	1	6 %	6 %	6 %	..	1 29/32 — 1 31/32	1 29/32 — 1 31/32	20/3	..	..	5 17 1
86,492	Do. do. do. 5 % Pref. ..	1	5 %	5 %	5 %	5 %	29/32 — 31/32	29/32 — 31/32	16/3	..	..	5 11 1
2,225,000	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %	104 —105	104 —105	105	104½	..	5 14 3
3,725,000	Do. do. Def. Stock	100	6 %	6 %	6 %	6 %	138 —140	136 —138	138½	137	—2	4 6 11
15,000	Do. do. 6 % Cum. 1st Pref.	10	6 %	6 %	6 %	6 %	10 — 10⅜	10 — 10⅜	..	..	..	5 11 8
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	6 %	6 %	6 %	10⅜ — 11	10⅜ — 11	10½	..	..	5 9 1
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %	5⅜ — 6⅛	5⅜ — 6	5⅜	5⅛	— ⅛	4 3 4
2,300,000	Do. do. 3½ % Deb. Stock Red. ..	Stock	3½%	3½%	3½%	3½%	99 —101	99 —101	99½	99¼	..	3 9
1,983,593	Do. do. 4 % Deb. Stock Red... ..	100	4 %	4 %	4 %	4 %	99 —101	99 —101	99¼	99⅛	..	3 19
179,313	Oriental Telep. and Elec. 1 to 171,504, fully paid..	1	8 %	8 %	8 %	..	1⅜ — 1⅜	1⅜ — 1⅜	..	..	..	4 11 5
50,000	Do. do. do. 6 % Cum. Pref. ..	1	6 %	6 %	6 %	..	1 15/16 — 1 31/32	1 15/16 — 1 31/32	..	..	..	4 7 3
195,955	Do. do. do. 4 % Red. Deb. Stock..	100	4 %	4 %	4 %	4 %	87 — 89	87 — 89	..	..	..	4 9 11
99,400	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	100	4 %	4 %	4 %	4 %	98½ —100½	98½ —100½	..	..	..	3 19 7
11,889	Reuter's	8	5 %	5 %	5 %	..	7½ — 8	7½ — 8¼	..	..	+ ¼	4 17 7
145,955	Telephone Co. of Egypt, 4½ % Deb. Red.	100	4½%	4½%	4½%	4½%	96½ — 98½	96½ — 98½	..	..	..	4 11 5
2,992	Submarine Cables Trust..	Cert.	6 %	6 %	6 %	..	133 —136	133 —136	..	..	..	4 8 3
150,000	United River Plate Telephone	5	8 %	8 %	8 %	..	7½ — 7¾	7⅛ — 7¾	7 11/16	..	..	5 3 3
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	5 %	5⅛ — 5⅝	5⅛ — 5⅝	..	..	..	4 7 11
30,008	W. Coast of America, 1 to 30,000 & 53,001 to 53,008	2½	2½%	2½%	2½%	..	1½ — 1¾	1½ — 1⅝	23/9	..	..	4 3 4
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4 %	4 %	4 %	4 %	98 — 100	98 —100	..	..	..	4 0 0
207,930	Western Telegraph, Ltd., Nos. 1 to 207,930 ..	10	7 %	7 %	7 %	6 %	13½ — 14	13⅜ — 14 xd	13⅜	..	..	4 5 9
800,000	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	100 —102	100 —102	101	..	..	3 18 5
88,321	West India and Panama Telegraph	10	Nil	Nil	Nil	..	2⅝ — 2¾	2⅞ — 3⅛	65/-	56/10½	+ ⅛	Nil
34,563	Do. do. 6 % Cum. 1st Pref.	10	6 %	6 %	6 %	6 %	10 — 10⅛	10⅛ — 10⅝	10⅛	10 1/16	+ ⅛	5 12 11
4,669	Do. do. 6 % Cum. 2nd Pref.	10	£2 6	15 %	14½%	..	9 — 9⅛	9 — 9⅛	..	..	..	6 6 4
80,000‡	Do. do. 5 % Debs., Nos. 1 to 800 ..	100	5 %	5 %	5 %	5 %	101½—103½	101½—103½	..	..	..	4 16 7

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

640,000	Anglo-Argentine Trams, 5% Cum. 1st Pref. 1 to 640,000	5	..	..	5 %	..	4⅞ — 5⅛	5 — 5⅛	5⅛	5	+ ⅛	4 15 8
500,000	Do. 5 % 2nd Pref., 800,000 to 1,300,000	5	..	..	5 %	..	4⅝ — 4⅞	4⅝ — 5	96/10½	95/-	+ ⅛	5 0 3
4,465,674	Do. 4 % Deb. Stock	Stock	..	4 %	4 %	4 %	92 — 93½	92 — 93½	92⅝	92⅛	..	4 5 7
329,002	Auckland E. Trams, 5 % 1st Mort Deb. Stock ..	100	5 %	5 %	5 %	5 %	104½—106½	104½—106½	106½	105½	..	4 18 11
830,000	Babcock & Wilcox, 1 to 830,000	1	20 %	20 %	24 %	..	5⅝ — 5⅞	5⅝ — 5⅞	5 37/32	5 33/64	..	4 4 9
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000 ..	1	6 %	6 %	6 %	..	1⅜ — 1½	1⅜ — 1½	21/3	..	..	4 0 0
600,000	British Columbia E. Rail Def. Ord. Stock	100	8 %	8 %	8 %	..	145 —148	151 —155	158½	146¾	+6½	5 3 8
600,000	Do. Pref. Ord. Stock	100	5 %	6 %	6 %	..	125 —128	125 —128	126½	126	..	4 10 1
600,000	Do. 5 % Cum. Perp. Pref. Stock	100	5 %	5 %	5 %	..	108 —111	108 —111	110	109	..	4 5 9
230,800	Do. 4½ % 1st Mort. Deb., 1 to 6,250	40	4½%	4½%	4½%	4½%	102 —105	102 —105	104½	..	..	4 6 7
210,600	Do. 4½ % Vancouver Power Debs., 1 to 2,200	100	4½%	4½%	4½%	4½%	102 —105	102 —105	..	..	..	4 5 9
133,301	British Electric Traction	10	Nil	Nil	Nil	..	1⅛ — 2⅛	1¼ — 2¼	43/9	37/6	..	Nil
161,437	Do. do. 6 % Cum. Pref.	10	3 %	1½%	Nil	..	4⅛ — 5 1/16	4¼ — 5⅛	101/10½	96/10½	+ 1/16	Nil
1,473,653	Do. do. 5 % Perp. Deb. Stock ..	Stock	5 %	5 %	5 %	..	96 — 99	98 — 97	97½	95	—2	5 3 1
528,936	Do. do. 4½ % 2nd Deb. Stock Red.	100	4½%	4½%	4½%	4½%	75 — 80	75 — 80	79	77½	..	5 9 9
100,000	British Insulated and Helsby Cables	5	10 %	10 %	10 %	10 %	7 — 7⅛	6⅞ — 7⅛ xd	..	..	..	6 17 11
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	5¾ — 6¼	5¾ — 6¼	6⅛	..	..	4 16 0
500,000	Do. do. 4½ % 1st Mort. Deb. Red...	100	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	4 8 3
201,579‡	British Thomson-Houston 4½ % 1st Mort. Debs. ..	100	4½%	4½%	4½%	4½%	96 — 99	96 — 99	..	..	..	4 10 11
500,000	British Westinghouse 10 % Pref., 1 to 200,000 and 275,001 to 575,000 Non cum.	5	Nil	Nil	Nil	..	⅜ — ⅝	⅛ — ⅜	7/-	..	— ⅛	Nil
1,241,353	Do. do. 4 % Mort. Deb. Stock ..	100	4 %	4 %	4 %	4 %	59 — 62	59 — 62	60½	..	..	6 9 1
50,000	‡Browett, Lindley & Co., Ord.	1	Nil	Nil	Nil	..	9/16 — 11/16	9/16 — 11/16	..	..	..	Nil
50,000	Do. do. 6 % Cum. Pref.	1	Nil	Nil	Nil	..	14/6 to 15/6	14/6 to 15/6	..	..	..	Nil
140,838	Brush Electrical Engineering, Ord., 1 to 140,338 ..	2	Nil	Nil	Nil	..	1/16 — 1/8	1/16 — 1/8	..	..	..	Nil
199,835	Do. do. Non-cum. 7 % Pref... ..	2	Nil	Nil	Nil	..	1/8 — 3/16	1/8 — 3/16	..	..	..	Nil
125,000‡	Do. do. 4½ % Perp. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	56 — 61	56 — 61	..	..	..	7 7 7
125,000‡	Do. do. 4½ % Perp. 2nd Deb. Stock..	Stock	4½%	4½%	4½%	4½%	38 — 43	38 — 43	..	..	..	10 9 4
137,610	Calcutta Trams, 1 to 137,610	5	6 %	4½%	4½%	..	5⅜ — 5⅞	5⅜ — 5⅞	5 11/16	5 27/32	..	3 16 7
47,295	Do. 5 % Cum. Pref., 1 to 47,295	5	5 %	5 %	5 %	..	4⅝ — 5⅛	4⅝ — 5⅛	5⅛	5 5/32	..	5 0 0
350,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	97 — 100	97 —100	..	..	..	4 10 0
35,000	Callender's Cable Construction shares	5	15 %	15 %	10 %	..	9¼ — 9⅝	9¼ — 9⅝	9 1/16	..	..	5 2 7
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	..	4⅝ — 5⅛	4⅝ — 5⅛	..	..	..	4 17 1
300,000	Do. do. 4½ % 1st Mort. Deb. Red.	Stock	4½%	4½%	4½%	4½%	102 —104	102 —104	..	..	..	4 6 7
491,222	Cape E. Trams., 1 to 491,222	1	Nil	Nil	Nil	..	7/16 — 9/16	7/16 — 9/16	..	..	..	Nil
450,000	Castner-Kellner Alkali, 1 to 450,000	1	12 %	12½%	17½%	..	3¼ — 3⅜	3 13/16 — 3 15/16	65/7½	..	..	5 7 8
205,369	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½%	4 %	4½%	4½%	103 —106	103 —106	..	..	..	4 4 11
1,854,720	Central London Railway, Ord. Stock	Stock	3 %	3½%	3 %	3 %	69 — 71	72 — 74	73½	70	+3	4 1 1
572,640	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %	85 — 87	86 — 88	88	..	+1	4 10 11
572,640	Do. do. Def. do.	Stock	2 %	2½%	2 %	2 %	53 — 55	55 — 57	57	55	+5	3 10 2
1,480,000	City and South London Railway	Stock	2½%	1¼%	1½%	1½%	35 — 36	34½ — 35½	35½	34	— ½	4 4 6
85,000	Crompton & Co., Nos. 1 to 85,000	8	5 %	Nil	Nil	..	⅜ — ½	⅜ — ½	..	..	..	Nil
100,000‡	Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 1,100 of £50 Red	..	5 %	5 %	5 %	5 %	70 — 80	70 — 80	..	..	..	6 0 5

* Unless otherwise stated, all shares are fully paid. ‡ From Manchester Share List.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—(*Continued.*)

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years. 1907.	1908.	1909.	1910.	Closing Quotations March 21st.	Closing Quotations March 28th.	Business done week ended Mar. 28th, 1911. Highest	Lowest	Rise + or Fall —	Present Yield per cent. £ s. d.
230,000	Dick, Kerr & Co., 1 to 230,000	1	10 %	6 %	5 %	..	7/8 — 1	7/8 — 1	..	..	..	5 0 0
305,000	Do. do. 6 % Cum. Pref., 1 to 305,000	1	6 %	6 %	6 %	..	1 — 1 1/8	1 — 1 1/8 xd	..	..	..	5 6 8
235,430	Do. do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	97 —100	97 —100	..	..	..	4 10 0
60,000	Dublin United Trams. (1896), 6 % Pref., 1 to 60,000	10	6 %	6 %	6 %	6 %	12 1/2 — 13 1/4	12 1/4 — 13 1/4	..	..	..	4 10 7
99,261	Edison & Swan Utd., "A" shs., £3 pd., 1 to 99,261	5	2½%	Nil	Nil	..	15/16 — 1 1/16	15/16 — 1 1/16	11/6	..	..	Nil
17,139	Do. "A" shares, 01—017,139	5	2½%	Nil	Nil	..	1 1/8 — 2 3/8	1 1/8 — 2 3/8	42/6	..	..	Nil
877,895	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	67 — 71	69 — 73	70 1/2	70 1/2	+2	5 9 7
67,720	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	5 %	80 — 83	78 — 81 xd	..	..	..	6 3 5
112,100	Electric Construction, 1 to 112,100	2	Nil	Nil	Nil	..	3/4 — 1	3/4 — 1	17/-	16/9	..	Nil
31,890	Do. do. 7 % Cum. Pref., 1 to 31,390	2	7 %	7 %	7 %	..	1 1/2 — 2	1 1/2 — 2	38/9	..	..	7 0 0
25,000	General Electric Co. (1900), 5 % Cum. Pref.	10	5 %	5 %	5 %	..	8 — 8 1/2	8 — 8 1/2	..	..	..	5 17 8
200,000	Do. do. 4 % Mort. Deb.	Stock	4 %	4 %	4 %	4 %	85 — 90	83 — 88 xd	..	..	..	4 10 11
78,000	Gt. N. & City Rail. Pref. Ord. "A" 4 %, 1 to 78,000	10	¾%	Nil	Nil	..	3/4 — 1	1 1/8 — 1 1/2	27/6	..	+ 1/2	Nil
96,000	Greenwood & Batley, 7 % Cum. Pref.	10	7 %	7 %	7 %	..	10 1/4 — 10 3/4	10 1/4 — 10 7/8	..	..	..	6 10 3
80,000	Do. do. 5 % Mort. Debs.	100	5 %	5 %	5 %	5 %	102 —103 1/4	102 —103 1/4	..	..	..	4 16 10
40,000	Henley's (W.T.), Telegraph Works, Ord.	5	15 %	15 %	15 %	15 %	12 1/2 — 13 1/2	12 — 12 1/2 xd	..	..	..	5 9 1
40,000	Do. do. 4½ % Pref.	5	4½%	4½%	4½%	4½%	4 1/2 — 5 1/8	4 1/2 — 5 1/8	5 1/32	..	..	4 7 10
150,000	Do. do. 4½ % Mort. Deb Stock	Stock	4½%	4½%	4½%	4½%	107 —109	107 —109	..	..	..	4 5 9
50,000	India-Rubber, Gutta-percha & Telegraph Works	10	10 %	10 %	10 %	..	16 — 16 3/4	16 — 16 3/4	16 1/2	..	..	5 19 5
37,500	†Liverpool Overhead Railway, Ord.	10	¾%	Nil	Nil	1½%	2 1/2 — 2 3/4	2 1/2 — 2 3/4	..	..	+ 1/16	5 9 1
10,000	† Do. do. Pref., fully paid	10	5 %	5 %	5 %	5 %	8 1/2 — 8 3/4	8 1/2 — 8 3/4	..	..	— 1/16	5 15 11
600,070	London United Trams. (1901) 1 to 50,007	10	3 %	Nil	Nil	Nil	1 1/2 — 2 1/2	1 1/2 — 2 1/2	..	..	..	Nil
399,930	Do. do. 60,008 to 100,000	10	3 %	Nil	Nil	Nil	1 1/2 — 2 1/2	1 1/2 — 2 1/2	..	..	..	Nil
125,000	Do. do. 5 % Cum. Pref., 1 to 125,000	10	5 %	3 3/4%	Nil	Nil	2 3/4 — 3 1/4	2 3/4 — 3 1/4	..	..	..	..
1,649,980	Do. do. 4 % 1st Mort. Deb. Stock.	100	4 %	4 %	4 %	4 %	73 — 77	73 — 77	75	..	..	5 3 11
5,732,062	Metropolitan Consolidated	100	1½%	1½%	1 %	1¼%	52 3/4 — 53 1/4	53 1/4 — 53 3/4	51 3/4	52 3/4	+ 1/2	2 1 10
2,640,914	Do. Surplus Lands	100	2½%	2½%	2¾%	2¾%	66 — 68	66 — 68	67 1/2	61	..	4 0 11
3,335,000	Do. District	100	Nil	Nil	Nil	Nil	29 3/4 — 30 1/4	31 1/2 — 31 3/4	32 5/16	30 1/4	+1 1/4	Nil
391,337	Metropolitan Electric Trams., Ord.	1	..	4½%	5%	5¼%	1 1/2 — 1 1/2	1 1/2 — 1 1/2	..	..	— 1/32	5 7 4
314,016	Do. do. Defd.	1	Nil	Nil	Nil	Nil	3/32 — 5/32	3/32 — 5/32	3/3	..	..	Nil
500,000	Do. do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	11/16 — 13/16	11/16 — 13/16	..	..	..	5 9 7
589,183	Do. do. 4½ % Deb. Stock Red.	100	4½%	4½%	4½%	4½%	103 —104	102 —104	102 1/2	..	..	4 6 7
$10,823,200	Mexico Trams Co., Common Stock	..	..	..	6 %	..	125 —126	125 1/4 —126 1/2	126 1/2	125 3/4	+ 1/2	4 14 10
$9,000,000	Do. 1st Mort. 50-year 5 % Gld. Bds.	..	..	5 %	5 %	..	95 — 96	95 — 96	96 1/4	95	..	5 4 2
245,000	Potteries Electric Traction	1	4 %	Nil	2 %	..	3/16 — 13/32	3/16 — 13/32	6/9	..	..	4 6 7
245,000	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	..	3/16 — 13/32	3/16 — 13/32	13/6	13/1½	..	6 17 11
245,000	Do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	81 — 84	83 — 88	..	..	+¼	5 2 3
37,350	Telegraph Construction and Maintenance	12	17½%	15 %	17½%	20 %	36½ — 38½	35½ — 37½	37½	36	—1	6 8 0
140,000	Do. 4 % Deb. Bds., 1 to 1,500 Red., 1919	100	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 5 0
1,000,000	Underground Electric Railway, 5 % Prior Lien	..	..	5 %	5 %	..	102 —103	102 —103	102 3/4	102 1/2	..	4 17 1
2,818,700	Do. do. 4½ % Bonds	..	..	4½%	4½%	..	97 — 99	98 —100	99	98 3/4	+1	4 10 0
4,928,050	Do. do. 6 % Income Bonds	..	..	..	..	1 %	53 — 55	57 — 59	58 1/2	53 1/2	+4	1 13 11
66,666	Willans & Robinson, 1 to 30,000 & 80,001 to 116,666	1	10 %	5 %	Nil	..	3/4 — 7/8	3/4 — 7/8	..	..	..	..
66,666	Do. 6 % C.P., 30,001 to 80,000 & 125,001 to 141,666	5	6 %	6 %	3 %	..	1 1/4 — 1 1/2	1 1/4 — 1 1/2	..	..	..	12 0 0
215,769	Do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	4 %	4 %	55 — 65	55 — 65	58 1/2	..	..	6 8 1

ELECTRICITY SUPPLY COMPANIES.

80,449	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 80,449	5	10 %	10 %	10 %	10 %	7 3/8 — 7 7/8	7 1/8 — 7 3/8 xd	..	..	..	6 12 3
9,551	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	7 1/8 — 7 3/8	7 1/8 — 7 1/4 xd	..	..	..	4 11 1
402,000	Central Electric Supply 4 % Guar. Deb. Stock	100	4 %	4 %	4 %	4 %	99 —103	99 —103	..	..	..	3 17 8
80,300	Charing Cross and Strand Electricity Supply	5	5 %	5 %	5 %	5 %	4 — 4 1/8	4 — 4 1/8	..	..	..	5 11 1
80,000	Do. do. do. 4½ % Cum. Pref.	5	4½%	4½%	4½%	4½%	4 1/8 — 4 3/8	4 1/8 — 4 3/8	..	..	..	4 17 4
80,000	Do. "City Undertaking" 4½ % Cum. Prf.	5	4½%	4½%	4½%	4½%	3 7/8 — 4 1/8	3 7/8 — 4 1/8	82/6	78/9	..	5 2 10
445,736	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	95 — 97	95 — 97	..	..	..	4 2 6
49,436	Chelsea Electricity Supply, Ord.	5	4½%	4½%	4½%	5 %	4 — 4 1/4	4 — 4 1/2	85/-	84/6	..	5 11 1
175,000	Do. do. 4½ % Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	4 8 3
70,595	City of London Elec. Lighting, Ord. 40,001—110,595	10	6 %	6 %	7 %	7 %	12 — 12 1/4	11 3/8 — 12 1/8 xd	12 1/8	11 3/4	..	5 19 2
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	6 %	12 — 13	11 3/4 — 12 1/4 xd	..	..	..	4 16 0
400,000	Do. 5 % Db. Stk.	Stock	5 %	5 %	5 %	5 %	119 —123	119 —123	..	..	..	4 1 4
800,000	Do. 4½ % 2nd. Db. Stk.	100	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
50,000	County of Durham Electrical Power, Ord.	5	2 %	Nil	Nil	..	1 1/2 — 2	1 1/2 — 2	..	..	..	Nil
50,000	Do. do. do. 5 % Pref.	5	5 %	5 %	5 %	..	2 3/4 — 3 1/4	2 3/4 — 3 1/4	..	..	..	7 16 10
250,000	Do. do. do. 5 % 1st Mtg. Deb.	Stock	..	5 %	5 %	5 %	92 — 94	92 — 94	..	..	..	5 6 5
40,000	County of London Electric Lighting, Ord. 1—40,000	10	5 %	5 %	5 %	5 %	7 3/4 — 8 1/2	7 7/8 — 8 3/4 xd	8 5/32	7 25/32	..	6 3 1
55,000	Do. do. 6 % Pref., 40,001—80,000 and 120,001—125,000	10	6 %	6 %	6 %	6 %	10 3/4 — 11 3/8	10 3/8 — 11 1/4 xd	11 1/16	10 7/8	..	5 7 3
450,000	Do. do. 4½ % Deb. Stock	Stock	4½%	4½%	4½%	4½%	108 1/2 —111 1/2	108 1/2 —111 1/2	..	..	..	4 0 9
450,000	Do. do. 4½ % 2nd. Deb. Stock	Stock	4½%	4½%	4½%	4½%	100 —103	100 —103	102	..	..	4 7 5
80,000	Edmundson's Electric Corporation, Ord. Shares	5	Nil	Nil	Nil	..	1/8 — 3/16	1/8 — 3/16	..	..	..	Nil
80,000	Do. do. 6 % Cum. Pref.	5	Nil	Nil	Nil	..	2 1/4 — 2 3/4	2 1/4 — 2 3/4	..	..	..	Nil
430,500	Do. do. 4½ % 1st Mort. Deb. Stk.	100	4½%	4½%	4½%	4½%	83 — 86	84 — 87	85½	85	+1	5 3 6
$8,150,000	Electrical Dev. Co. of Ontario, 5% 1st Mtg. Gold Bnds.	$500	..	5 %	5 %	..	81 — 83	81½ — 83½	..	..	+ ½	5 17 0
10,000	Folkestone, 1 to 10,000	5	5½%	5½%	5½%	6 %	4 1/2 — 4 3/4	4 1/2 — 4 3/4	..	..	..	5 15 9
10,000	Do. 5 % Cum. Pref., 1 to 10,000	5	5 %	5 %	5 %	5 %	4 3/4 — 5 1/8	4 3/4 — 5 1/8	..	..	..	4 11 11
94,350	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	97 —100	97 —100	..	..	..	4 10 0
15,000	Hove, 1 to 15,000	5	8½%	8½%	8½%	9 %	6 3/8 — 7 1/8	6 3/8 — 7 1/8	7 1/16	..	..	5 19 4
$1,526,500	Kaministiquia Power Co., 5 % Gold Bnds.	100	..	5 %	5 %	..	102 —104	102 —104	103 3/8	..	..	4 16 2
21,000	Kensington and Knightsbridge Electric Ord.	5	10 %	8 %	8 %	9 %	7 — 7 3/4	7 — 7 3/4	..	..	..	5 16 2
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	4 %	93 — 95	93 — 95	..	..	..	4 4 3
111,000	London Electric Supply Corporation, Limited, Ord.	3	2½%	3 %	2 %	2 %	1 3/8 — 1 15/16	1 3/8 — 1 15/16	..	..	..	3 3 6
90,000	Do. do. do. 6 % Pref.	5	6 %	6 %	6 %	6 %	4 3/8 — 5 1/8	4 3/8 — 5 1/8	98/9	..	..	5 17 1
387,355	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4½%	4 %	4 %	4 %	91 — 94	91 — 94	92 3/4	92	..	4 5 1
200,000	Metropolitan Electric Supply, 100,001 to 300,000	5	6¾%	5 %	5 %	5 %	4 1/8 — 4 3/8	3 15/16 — 3 7/8 xd	85/-	83/9	..	5 12 8
76,121	Do. 4½ % Cum. Pref. 1—76,121	5	4½%	4½%	4½%	4½%	4 3/8 — 4 5/8	4 3/8 — 4 5/8	..	..	..	4 17 4
250,000	Do. 4½ % 1st Mort. Deben. Stock	Stock	4½%	4½%	4½%	4½%	101 —104	101 —104	..	..	..	4 6 7
248,000	Do. 3½ % Mort. Deben. Stock Redem.	Stock	3½%	3½%	3½%	3½%	84 — 87	85 — 88	86	..	+1	3 19 7
$5,929,600	Mexican Electric Light Co., 5% 1st Mtg. Gold Bnds	100	5 %	5 %	5 %	5 %	88 — 90	88 — 90	89	88 1/4	..	5 11 1
$13,585,000	Do. Light and Power Co., Ltd., Common	$100	4 %	3½%	4 %	..	87 — 89	88 — 90	89/2	89	+1	4 8 11
$5,400,000	Do. do. 7% Cum. Pref. Stk.	Stock	..	7 %	7 %	..	108 —111	108 —111	109 1/2	108 3/4	..	6 6 2
$12,000,000	Do. do. 5% 1st Mtg. Gold Bnds.	100	..	5 %	5 %	5 %	93 — 95	93 1/4 — 95 1/4	94 1/4	93 1/2	+ 1/2	5 4 9
250,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	4½%	97 — 99	97 — 99	94 1/2	..	..	4 10 11
150,491	Newcastle-on-Tyne, 1 to 50,000 & 57,010 to 137,500	5	8 %	2½%	4 %	4 %	4 1/8 — 4 3/8	4 1/8 — 4 5/8	..	..	..	4 6 6
137,500	Do. 5% Pref., 1 to 137,500 Non. Cum.	5	5 %	5 %	5 %	5 %	4 3/8 — 4 5/8	4 3/8 — 4 5/8	..	..	+ 1/8	5 2 7
150,000	North Metropolitan Electric Power Supply Co., 5 % Mortgages (Red.), Nos. 1 to 1,500	100	..	..	5 %	..	98 — 100	97 1/2 — 99 1/2	..	..	..	5 0 0
10,852	Notting Hill Electric Lighting	10	7½%	7 %	7½%	8 %	12 — 12 3/4	12 — 12 3/4	..	..	..	6 5 6
20,000	Oxford, 1 to 96 and 407 to 20,310	5	7 %	7 %	7 %	..	6 — 6 1/2	6 — 6 1/2	..	..	..	5 7 8
120,000	River Plate Elcty. Co. Ord.	Stock	6 %	8 %	9 %	..	225 —235	225—235	..	..	..	3 16 6
100,000	Do. do. 6% Non Cum. Pref.	Stock	6 %	6 %	6 %	..	103 —113	103—113	..	..	..	5 6 2
200,000	Do. do. 5% Deb. Stk. Red.	100	5 %	5 %	5 %	5 %	102 —104	102 —104	..	..	..	4 16 3
40,000	St. James' and Pall Mall Electric Light, Ord.	5	10 %	10 %	10 %	10%	8 3/8 — 8 5/8	8 3/8 — 8 5/8	8 3/8	..	..	5 12 8
20,000	Do. do. 7 % Pref. 20,081 to 40,080	5	7 %	7 %	7 %	7 %	6 3/4 — 7 1/4	6 3/4 — 7 1/4	..	..	..	4 16 7
150,000	Do. do. 3¾ % Deb. Stock Red.	100	3¾%	3¾%	3¾%	3¾%	86 — 88	86 — 88	65/-	..	..	3 19 7
12,000	Smithfield Markets Electric Supply, Ord.	5	Nil	Nil	Nil	Nil	1½ — 2	1½ — 2	..	..	..	Nil
65,000	South London Electric Supply, Ord.	4	4 %	5 %	5 %	5 %	3 — 3 3/8	2 15/16 — 3 3/16 xd	..	..	..	6 7 0
100,000	Do. do. 5 % 1st Mort. Deb.	100	..	5 %	5 %	5 %	101 —104	101 —104	..	..	..	4 16 3
120,000	South Met. Elec. Lt. & Power, Ord.	1	2½%	2½%	Nil	Nil	3/16 — 5/16	1/16 — 3/16	..	..	..	Nil
142,968	Do. do. 7 % Pref.	1	7 %	7 %	7 %	7 %	1 — 1 1/8	1 1/16 — 1 1/16	..	..	+ 1/16	5 17 11
240,000	Do. do. 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	4½%	97 — 99	95 — 98 xd	..	..	..	4 11 10
80,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	..	5/8 — 7/8	5/8 — 13/16 xd	..	..	..	20 0 0
50,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	..	1 1/4 — 2 3/8	1 1/8 — 2 5/8 xd	..	..	..	4 16 8
271,700	Do. do. 4½ % 1st Mort. Db. Stk. Red.	100	4½%	4½%	4½%	4½%	83 1/2 — 85 1/2	84 — 86 xd	..	..	..	5 4 8
808,000	Victoria Falls Power Co., Pref. Nos. 1 to 808,000	1	..	5 %	..	..	3/4 — 1	3/4 — 1	19/3	..	..	5 0 0
110,000	Westminster Electric Supply, Ord.	5	10 %	10 %	10 %	10%	7 3/4 — 8 1/2	7 3/4 — 8 1/2	8 1/2	8 1/16	..	5 19 5
81,379	Do. do. 4½ % Cum. Pref. (Reduced from 5% since 31st Dec., 1905)	5	4½%	4½%	4½%	4½%	5 — 5 1/8	5 — 5 1/8	..	..	..	4 3 9

* Unless otherwise stated, all shares are fully paid. † Quotations on Liverpool Stock Exchange.

Bank rate of Discount 3 per cent. March 9th, 1911.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING FEBRUARY, 1911.

THE returns of electrical export business for February—although for a short month—are a considerable improvement on those of the preceding month, the totals being £370,035 and £341,839 respectively.

Actually a very small telegraphic export occurred during February, and excluding this rather fluctuating section, the general business of the month reached a higher value (£341,954) than we have previously recorded, and by comparison, nearly £60,000 above the average value of general business obtaining during the 12 months of 1910. Machinery exports considerably exceeded those of January, and while the cable sections show a decrease, several of the others—and particularly the telephone section—show improvement of the January returns.

Turning to the imports, the total, £178,592, compares with £207,430 in the preceding month, and is roughly £10,000 less than the average monthly value recorded in 1910. In this section of the table, most noteworthy is the continued fall in lamp importations, the value, £33,390, comparing with £44,678 in January, and as much as £78,000 in December last. Both machinery and cable imports were also less than in January.

In the re-export section, the total of £19,535 shows a decrease of rather over £3,000, as compared with the previous return.

In general the prominent purchasing countries, and those importing into this country, show little change; curiously enough, Belgium was a good customer in January, due to a considerable telegraphic purchase.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Country receiving exports and importing.	Electrical goods and appliances.	Wires and cables, rubber and other insulations.	Electric lighting fittings and accessories.	Electric lamps and parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
	£	£	£	£	£	£	£	£	£	£	£	£
Russia, Sweden, Norway and Denmark ...	661	137	170	233	196	3,174	1,582	30	...	787	203	7,173
Germany	334	275	19	229	1,388	1,290	370	13	...	...	77	3,995
Netherlands, Java and Dutch Indies	308	2,579	182	70	76	234	16	4	...	5	5	3,479
Belgium	299	876	81	112	58	3,604	597	...	...	831	812	7,270
France and French Africa	2,243	16	666	502	11	2,068	187	37	63	45	13,819	19,657
Portugal	33	170	20	142	...	137	...	17	14	...	92	625
Spain, Canary Isles and Spanish N. Africa ...	237	136	90	24	9	2,117	983	6	...	13	10	3,625
Switzerland, Italy and Austria-Hungary ...	237	153	65	137	2	3,992	...	293	...	63	800	5,742
Greece, Roumania and Turkey	144	45	27	...	3	47	22	82	...	7	1,739	2.116
Channel Isles, Gibraltar, Malta and Cyprus ...	127	220	27	65	51	201	...	11	...	34	218	954
U.S.A., Philippines and Cuba	539	...	13	235	255	599	...	22	1,401	...	369	3,433
Canada and Newfoundland	972	3,163	846	1,258	1,029	11,921	4	537	56	...	477	20,263
British West Indies, British Honduras and British Guiana	147	...	27	628	...	264	...	13	...	...	...	1,079
Mexico	...	650	...	...	...	86	22	...	...	103	128	989
Peru, Central America and Uruguay... ...	10	80	200	56	3	658	...	10	...	...	73	1,090
Chile	166	78	132	61	164	2,219	6	97	28	157	267	3,375
Brazil	109	851	382	853	263	5,991	4,718	1,457	...	2,624	1,683	18,931
Argentina	1,644	6,472	839	2,557	665	13,720	426	2,803	46	920	772	30,864
Egypt, Tunis and Persia	271	575	130	...	...	2,279	...	184	11	207	458	4,115
British West Africa and Ascension	5	16	180	17	134	246	...	...	24	24	296	942
Rhodesia, O.R.C. and Transvaal	2,120	985	87	577	...	10,485	...	195	9	4,465	968	19,891
Cape of Good Hope	1,001	1,744	348	754	64	690	...	117	48	1,954	19	6,739
Natal	2,197	9,461	287	886	96	10,067	34	412	...	52	82	23,574
Zanzibar, Brit. East Africa, Mauritius & Aden	94	24	34	204	...	12	...	9	...	16	2	395
Madeira and Portuguese Africa	92	1,342	63	897	6	1,235	...	...	...	21	1,408	5,064
China and Siam	666	4,116	510	110	198	5,226	277	...	...	237	225	11,565
Japan and Korea	131	11,087	101	244	1,041	11,271	864	...	...	16,389	523	41,651
India	1,407	9,892	3,337	1,788	140	6,977	544	1,098	202	1,684	1,635	28,704
Ceylon	268	464	218	8	89	323	...	15	...	1,189	2	2,576
Straits Settlements, Fed. Malay States and Sarawak	236	484	394	69	30	257	820	33	...	236	47	2,606
Hong Kong	322	496	631	56	26	2,141	5	14	62	...	...	3,753
West Australia	484	619	43	378	464	7,839	...	213	...	3,006	35	13,081
South Australia	805	444	...	50	13	702	...	36	...	148	49	2,247
Victoria	1,057	3,070	355	1,091	104	3,503	...	76	36	12,813	138	22,243
New South Wales	1,666	3,878	849	1,726	500	8,878	214	364	39	3,306	298	21,718
Queensland	45	135	41	60	...	5,341	148	26	...	9,064	295	15,155
Tasmania...	...	...	...	...	3	110	...	...	...	...	12	125
New Zealand and Fiji Islands	505	1,652	230	1,990	430	3,849	...	256	16	258	45	9,231
Total, £	21,582	66,385	11,624	18,067	7,511	133,753	11,839	8,480	2,055	60,658	28,081	370,035

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

Russia, Norway, Sweden and Denmark ...	...	...	28	172	...	1,133	60	527	25	3,028	4,973
Germany	241	4,280	2,025	26,242	1,584	55,419	1,442	2,029	6,437	26,408	126,107
Holland	...	...	...	2,161	...	136	...	9	...	39	2.345
Belgium	637	673	25	43	85	424	693	646	78	4,785	8,089
France	118	32	139	2,899	266	491	...	2,420	2,791	2,616	11,772
Switzerland	43	618	...	29	36	465	...	3	27	5	1,226
Italy	106	196	15	...	...	30	...	...	...	4,832	5,179
Austria-Hungary	20	661	...	870	...	...	...	7	1,028	164	2,750
United States	2,283	2,124	338	974	16	5,150	4,558	94	102	417	16,056
Total, £	3,448	8,584	2,570	33,390	1,987	63,248	6,753	5,735	10,488	42,294	178,497

Additional imports :—Spain, carbons £95.

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

Various countries, mainly as above	2,129	3,009	...	3,812	...	4,080	...	323	335	5,847	...

TOTAL EXPORTS : £370,035. TOTAL RE-EXPORTS : £19,535. TOTAL IMPORTS : £178,592.

NOTE.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third columns contain many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns.

WHAT IS CAPITAL EXPENDITURE?

By "INTERESTED."

All repairs *must* be paid for from revenue account. Now, is that correct? Should *all* repairs be paid for out of revenue? Circumstances frequently alter cases, and this question of capital expenditure is one of those cases frequently altered. Let me commence by giving a concrete example by way of demonstrating the meaning: A contract is secured by a firm of engineers to carry out certain mains extensions for a supply undertaking at a cost of about £2,000. The whole of that sum in one lump will be booked as capital expenditure, and readers will agree, I am sure, that that is quite in order. Now, on the other hand, suppose the work of laying these cables, and building boxes where necessary, and jointing, &c., were carried out by the Council's own staff of men, and that the course of same was across some heavy roads; a blacksmith and mate would be hard at work during the time the job was in progress repairing wedges, picks, &c., used in breaking up the concrete road beds. Should that expense be charged to revenue? Again, one of the hand-carts is damaged, and the carpenter spends a few hours and uses a little timber repairing same; is that a proper revenue charge? Yet other points are the jointers' blow lamps, compound buckets, and similar tools which may require a little repairing whilst being used on this particular job; are these also fair charges for revenue to bear? Many other minor expenses similar to these occur on works of this description, and, in fact, on any work either inside or outside the station, and it seems hardly fair to charge all these little jobs to revenue when capital would have borne the cost had some outside firm secured the contract for carrying out the whole thing. Yet there are some folk who claim that no matter what form, and under what conditions repairs are executed, revenue must bear the brunt of expense, and poor "distribution" or "revenue repairs" is saddled with the extra burden to swell their already heavy loads. At the end of the year these small jobs are difficult to keep in mind or trace back, and it is really wonderful how a number of recurring small items mount up in the course of 12 months.

In a station where the practice is to carry out extensions so far as possible with their own staff, difficulty is sometimes experienced in drawing a line between capital and revenue. One case in mind is where a certain amount of alteration to existing pipework became necessary in order to work in a new arrangement of steam and feed pipes for some new boilers. Had the boiler-makers obtained the order for the supply and erection of boilers, pipes, valves, &c., together with carrying out the necessary alterations to the old pipe system, no doubt the whole sum would have been allocated to capital. However, in this particular instance the works staff carried out the pipe alterations, as well as erecting and connecting up the new pipework, and the cost of the alterations was charged to revenue.

Naturally, in instances where revenue bears such charges as these, the stability of the undertaking financially is made more secure thereby, as the borrowed capital is reduced by corresponding amounts, but where stations are struggling to keep off the rates, advantage should be taken of all these little items in order to enable the department to pay its way and make a profit for the time being. In numerous cases, in fact, in almost every instance, undertakings look like paying their way eventually if given a fair chance, so that every effort should be made to reduce any deficit during those few years while the ventures are getting over their "bad time," as it were. I do not mean to suggest unfair methods. Far be from me any such intention. I mean that all these little details should receive careful attention, and every amount should be put to capital account which can rightly be so charged.

How to allocate salaries is another question upon which there are many divergent opinions. In some places the custom is to lump the whole of the engineers' salaries to management, whereas in others, with the exception of the chief and chief assistant, the salaries are allocated to the various works upon which the respective men have been engaged, and are shown under the heading of wages in the published analysis of accounts. In this manner a certain proportion is charged to any work of a capital nature in progress at the time. The same reasoning applies equally well here. If the accounts of the department can stand all the salaries being paid from revenue, well and good; but on the other hand, when the undertaking is in some straits to make headway, then by all means allocate a fair share of the engineers' salaries to capital, including those of the chiefs.

Under any circumstances it is entirely wrong to charge revenue work to capital, but capital can always be placed to revenue account, and occasionally profitably be paid for out of revenue. Large sums spent in this manner can be shown in the accounts separately under such headings as "special items," "net revenue," or any other suitable name.

SOME NOTES ON METER CONSTANTS.

By "X. Y. Z."

Most people who have had to test meters in any quantity will have experienced the inconvenience occasioned by the adoption by various manufacturers of different formulas for use in connection with the ordinary revolution test. All motor meters have a testing constant, but, unfortunately, at present the meaning of this constant is by no means invariable. The disadvantages of this variation are more subtle and serious than is generally appreciated.

The best method of testing a meter is by a dial or time test. In this method a known amount of electricity is passed through the meter, and by a direct reading of the dials the true is compared with the indicated amount. As the dial test necessarily becomes impracticable with small currents, the revolution test is usually resorted to. This briefly consists in taking the angular speed of the meter at a given load, and obtaining by calculation from these particulars a number which should be constant for all loads. The variation in the method of calculating this constant is not only a disadvantage in view of the greater tax on the memory of the tester, but in the case of an inaccurate meter involves a curious difference in the method of calculating the percentage error.

The most usual testing constants represent the following numbers: Amp.-seconds per revolution; watt-hours per revolution; watt-seconds per revolution; revolutions per ampere-minute; revolutions per unit.

It is immediately apparent that not only are these various constants calculated in different ways, but the physical significance of the first three is quite different from that of the last two.

The mode of calculation of the inaccuracy of a faulty meter may now be considered. Taking first the case of a meter having a constant of the first class, we have for one revolution of a correct meter, $K = C\,T$; considering a faulty meter with the same current, $K_1 = C\,T_1$.

If the quantity $C\,T$ had been passed through the faulty meter, the armature would have executed $\frac{K}{K_1}$ revolutions.

Since the readings of the dial are necessarily proportional to the angle described by the armature, the dial readings of the incorrect and correct meters will bear the same ratio.

The percentage error of the meter will be $100\,\frac{K - K_1}{K_1}$.

Next, considering the case of a meter having a constant of the second class, it is readily seen that since the readings of the dial are proportional to the number of revolutions described by the armature, the ratio of K_1 of the incorrect meter to K of the correct meter will give the ratio of the dial readings of these meters corresponding to the passage through them of equal quantities of electricity.

The percentage error will be accordingly $100\,\frac{K_1 - K}{K}$.

For small inaccuracies the difference in the method of calculating the percentage error is not important, but with

greater inaccuracy it requires to be taken into consideration. To make this clearer, an example may be taken of a Chamberlain & Hookham meter having a testing constant of 4·00. Supposing, if we may of so excellent a meter, that, on testing, K_1 was found to be 3·00, the percentage error of the constant will be 25, but the inaccuracy of the meter $33\frac{1}{3}$ per cent. Or again, supposing that K_1, on testing, was found to be 5·00, the two errors would be respectively 20 per cent. and 25 per cent. It will thus be readily seen that, in the case of its being necessary to make an amendment to a consumer's account through the inaccuracy of a meter, it is essential, should the error be considerable, that due care be taken that the percentage be calculated correctly.

For the reasons set out above, the writer would strongly advocate the adoption by meter manufacturers of a standard testing constant. There is little doubt that of all those in use the "revolutions per unit" constant is the most rational, and is best fitted for standard and general adoption. Its significance is quite simple, as it represents the ratio of the angular speeds of the armature spindle and the spindle bearing the $\frac{1}{10}$-unit pointer; while the disadvantages that would be occasioned by its general adoption are so small, by comparison with its manifold advantages, as, in the opinion of the writer, to be negligible.

The writer may perhaps state that the first cause of the compilation of these few notes was his having his attention drawn to the fact that the time test and the revolution test of a meter did not agree, owing, of course, to the fact that the calculation of the error from the revolution test data was performed wrongly.

THE ENCLOSED ARC, OR THE METAL-FILAMENT LAMP?

By "PAM."

There can be very few people connected with the electrical business who do not now realise and admit the enormous benefits which have accrued throughout the trade from the introduction of the metal-filament lamp. It would be idle to disparage these lamps, which have given us such a magnificent reply to the incandescent gas mantle, and other forms of modern artificial illuminating apparatus and methods. They are continually bringing in new customers, and the old customers are jubilant over the magnificent improvements, and now that the central stations are recovering, or have already recovered, from the temporary check experienced at first, everyone seems happy and satisfied.

There is, however, the inevitable fly in the ointment, in this case internal competition between these lamps and arc lamps.

Even those who bestow only the most careless casual glance upon the advertisements in any of the electrical or trade papers cannot fail to have been impressed by the claims made as to the advantages of the new lamps over enclosed arc lamps. For instance, how very often one must have read that "they are cheaper to install," "do away with trimming and carbon costs," and the many similar statements which are made, and which undeniably give the impression that, generally speaking, the metal-filament lamp is superior to the enclosed arc lamp. But the important point is, how are these advertisements understood? There is no doubt that the statements referred to are quite true in substance, but at the same time they are tremendously misleading. Has the reader ever noticed that the metal-filament people do not advertise their lamps as cheaper to run (c.p. for c.p., and with all incidentals): that they never claim a higher efficiency (watts per candle), but only that their lamps are cheaper or better in certain respects, and has it never struck him as being strange that this should be so? There is little doubt but that it is only to a certain few, who have the requisite knowledge, time, and inclination to figure the thing out for themselves, that this view of the case has occurred, as a casual inquiry from one's friends or business acquaintances would immediately prove. Then rememb that a statement continually and systematically advertised becomes a definite fact to the vast majority of readers, whether it has any foundation in fact or otherwise, and you have the whole crux of the case.

The question will naturally arise, Why, if there is anything in the inferences made above, don't the arc lamp people, or whoever may be the sufferers, make a noise about it? and there you would ask a question which seems unanswerable.

The arc lamp makers and retailers have not had a very rosy time of it during the last two or three years, and that they should be content to let a large branch of their business be taken from them without some effort to save it seems to be absolutely beyond belief. The enclosed arc lamp is, of course, only a secondary part of the business, now that the flame lamp has been satisfactorily developed; but then, competition in this line is so very great that the profits on these lamps are not such as to enable the sellers to give up a good line without compunction. No; this cannot be the case, as is proved by the fact that the enclosed arc lamp is still advertised as much as ever it was. It is these advertisements that the whole thing depends on. Contrast them with those for the metal-filament lamps. The former (with only one or two exceptions in the last 12 months) give, as a rule, the name of the lamp, an illustration of the external appearance, and the name and address of the manufacturers or retailers. Very occasionally they go so far as to give a list price, but even then there is no lasting impression made on the mind of the reader, and without this what is the use of an advertisement?

Now turn to the advertisements for metal-filament lamps, and you will find either a very catchy little picture, or sequence of pictures, or a series of sharp, concise examples of the advantages claimed for the lamps. At any rate, there is generally something about them which claims the reader's attention, and so makes the expense of advertising money well spent.

It seems to be the old, old story, of an article which has held the market without competition for a long time, being ruined by a new (but not necessarily better) article, simply on account of the more up-to-date methods of selling of the more recently discovered apparatus.

Before going further, let us take a typical example of an instance where the two kinds of lamps are daily in active competition, and try to form some definite conclusion as to the merits of each.

Nothing could be better for this than an ordinary city or suburban shop with, say, eight lamps for either inside or outside lighting. Assume that each lamp is required to give about 650 c.p., energy is available at 4d. per unit, and the lighting hours are from dusk until 9 o'clock, or about 1,000 hours per annum.

With enclosed arc lamps, you can obtain the desired effect from lamps taking 600 watts each. Good lamps can be bought for £2 10s. each, and 20 per cent. per annum for depreciation is a very generous estimate. The trimming and cleaning can usually be undertaken by one of the usual staff, but as a rule, it is perhaps cheaper in the long run to put this job in the hands of the local electrician, or other competent person, who will willingly take the job on at, say, 7s. 6d. per visit.

For metal-filament lamps, it will be found that a standard 700 (Hefner) c.p. lamp will take 770 watts and give 630 British c.p., and have a life (average) of 1,000 hours.

From these figures we can compile the following summary of cost per annum:—

Enclosed Arc Lamps.			
Eight lamps complete, at 50s. each = £20, 20 per cent.	£4	0	0
Trimming and carbons (eight times)	3	0	0
Energy, 8 × 600 w. × 1,000 hours × 4d. per B.T.U. ...	80	0	0
	£87	0	0
Metal-Filament Lamps.			
Eight lamps, depreciation on lanterns, cleaning, &c., at 25s. each	£10	0	0
Energy, 8 × 770 w. × 1,000 hours × 4d. per B.T.U. ...	102	13	4
	£112	13	4

From the above it will be seen that, for an installation of this description, the metal-filament lamp is more costly than the enclosed arc lamp by nearly 30 per cent. Further than

this, no allowance has been made for the fact that the latter lamp undoubtedly gives a more pleasant and even light, being fitted with an opalescent globe, whereas this is not the case with the former, the figures being taken for an uninterrupted light, and the effect of the bunch of luminous wires is far from pleasing in a high-candle-power lamp.

The writer has heard it thoughtlessly suggested that the number of lamps should be increased and candle-powers reduced, but this does not help the job in the least; as capital and depreciation costs increase, current consumption remains the same, and more important, enclosed arc lamps taking as little as 250 watts are almost as efficient as the larger units, and are quite a satisfactory and practical article.

It would, therefore, seem that there is absolutely no reason why the enclosed arc lamp should be pushed out from the average everyday lighting job, and it is quite beyond comprehension that the people who sell them should have allowed things to go so far.

One thing is certain—if they don't wake up immediately and face the question in a sensible business-like manner, the lamp will very soon cease to live, except for the places where a good light for colour-matching is essential, or as a special article for the few people who can see a little further than the end of their noses, and who are not afraid of spending a few shillings more on the original outlay, which will be annually saved as a sort of dividend on the job.

THE TEMPERATURE COEFFICIENT FOR COPPER CONDUCTORS.

By HAROLD OHLSON.

In the majority of specifications for cable issued at the present time, the coefficient for correcting the resistance of the copper conductor to a standard temperature is given as "an average coefficient of ·00238 per degree Fahr." It is, presumably, derived from Messrs. Clark, Forde & Taylor's formula, and the table calculated from it, where the resistance rises from unity at 32° F. by an approximately constant increase per degree of ·00238. But this "average coefficient" is very misleading to the electrician, who, as a rule, wishes to correct from normal temperatures to a standard of either 60° or 75°. For example, let us suppose a resistance at 60° requires correcting to 75°; the only way in which the above constant may be used is as follows :—

$$R_{75} = R_{60} \frac{1 + \cdot00238\ (75 - 32)}{1 + \cdot00238\ (60 - 32)} = R_{60} \times 1\cdot0335.$$

It is, however, generally understood to mean that the coefficient between these temperatures is $1 + (\cdot00238 \times 15) = 1\cdot0357$, an error of nearly 1° F.

A temperature coefficient is always regarded as the ratio which the resistance at the observed temperature bears to the resistance at the standard temperature, which ratio must necessarily be equal to unity at the standard temperature. Therefore we cannot correct by a coefficient from any one temperature to any other unless the resistance at one of them be expressed as unity. The constant ·00238 is not a temperature coefficient as the term is generally used, but the common difference of the arithmetical progression of the resistances at each degree from unity at 32° F. For this reason we can only use the coefficients calculated from it to correct in one operation to a standard of 32°.

As a rule, however, we require to correct in one operation to a standard of 60°, and in order to obtain unity at this temperature by calculation from the coefficients from 32°, based on Messrs. Clark, Forde and Taylor's formula, we must divide all these coefficients by the coefficient for 60° = 1·06665. Therefore we must also divide the average difference between them (= ·002389) by the same amount = ·002389 ÷ 1·06665 = ·00224. If we may neglect in practice the slight divergence of the original formula from the true arithmetical progression, it is apparent that the common difference between the coefficients for a standard temperature of 60° F. is ·00224, *i.e.*, if the resistance at 60° be unity, the increase or decrease for each degree F. is a constant quantity equal to ·00224. The coefficient to quote would be a dividing one, and be expressed as $1 \pm (\cdot00224 \times$ difference from 60° of observed temperature), using the + sign for temperatures above the standard and the − sign for temperatures below. It is obviously incorrect to change the coefficient to a multiplying one for the lower temperatures, and continue the use of the + sign, as the specification of an "average coefficient" appears to allow. If we change a dividing to a multiplying coefficient, we must use the reciprocal of the former, and as the dividing coefficients are in arithmetical progression, their reciprocals are not, and no constant can be determined.

A similar formula could be used for corrections to 75° F. by altering the constant to ·00217.

PROCEEDINGS OF INSTITUTIONS.

The Electrical Undertaking of the Birmingham Tame and Rea District Drainage Board.

By Mr. L. F. Mountfort, A.M.I.C.E., A.M.I.E.E.

(*Discussion at Birmingham, February 8th*, 1911. *For abstract of paper, see p.* 449.)

Mr. W. J. Larke (B.T.-H. Co., Rugby) said he was associated with Mr. Watson and his staff in the design and carrying-out of the scheme, which comprised all the features of a complete power distribution system. The estimated saving on the electrical transmission scheme had been fully realised, although not only had the extra capital cost of the electrical scheme to be paid for, but also the writing-off of the value of the plant which it replaced, showing the possibilities of economy in such a case, even when on a small scale. The original scheme had been practically trebled in capacity in four years. He was inclined to think that the load factor should not be 40 per cent., but 20 per cent., since the second unit of the plant had not been taken into account. He did not think the author was justified in debiting the electric plant and the gas plant with the same amount per annum for wages. The ratio between the two expenditures ought certainly to be considerably in favour of the electrical plant. The type of pump with backward-curved vanes had a very limited application, since a very material increase in power required and volume delivered resulted from a comparatively small increase in speed. He endorsed the remarks of the author as to the suitability of squirrel-cage motors in connection with the use of turbine pumps with high speeds for mining work.

Mr. A. Pearson (Messrs. Crompton & Co.) congratulated the author upon having adopted low-speed short-circuited motors for driving the large centrifugal sewage pumps, and said the combination of a destructor plant with a purchased supply to carry the peaks appeared to be an ideal system of providing electrical power for sewage works.

Mr. W. E. Milns (Birmingham Corporation Electric Supply) said the author told the Institution that the annual costs on gas-engine driving were lower than those of electric motors; he gave an emphatic denial to the suggestion. The high cost of the electrical plant was due to the very low speed of the motors selected. For interest and depreciation 12½ per cent. was not too high a figure for the gas-engine scheme. The question of wages had already been raised. The estimated gas consumption was low, considering the nature of the load, and the fact that the running hours of gas engines were always more than those of electric motors on the same work. Electric motors should certainly be selected for work of this character, on the score of cost.

Mr. A. Home-Morton agreed that with the low annual load factor of storm-water pumping plants, high efficiency must give way to low first cost. Apart from the comparative figures, which were, at least, kind to the gas plant, this was a clear case for the use of purchased electrical energy at any reasonable figure.

Mr. S. P. Smith (General Electric Co.) said that means were now known whereby the speed of induction motors could be regulated over a wide range without seriously affecting the efficiency. To do this it was only necessary to take advantage of the transformer properties of the induction motor, and supply the rotor with a commutator by means of which the frequency of the rotor currents was converted to that of the supply system, so that the commutator could be connected to a pressure having the supply frequency. The excess power supplied to the stator was then no longer consumed in rotor resistances, but was returned to the line. Either shunt or series characteristics could be given to the motor as desired. The author strongly advocated the use of induction motors with squirrel-cage rotors, but these might give rise to surging troubles on switching in. In the present 225-h.p. motor, the short-circuit current was 3½ times the full-load current, viz., 75 amperes, and the starting current would be approximately 19 amperes. With this current and a 4 per cent. slip the starting torque was only some 12½ per cent. of the full-load torque, whereas in a liberal design 2 per cent. to 2½ per cent. slip might have been sufficient, improving the efficiency by a corresponding amount. It seemed reasonable to expect a motor rated at the normal output of the pump to cope with any torque that might be required of it, and in the extreme case of 100 per cent. overload it could easily be arranged for the

breaker to come out, for this was clearly not a practical condition of working. With an ordinary fall of head, say from 20 per cent. to 30 per cent., the motor should work quite well on this overload. By rating the motors in this way, much better power factors would have been obtained on normal working.

Mr. A. L. Rawlings asked whether the characteristic curves of the ordinary type of centrifugal pump were drawn from the results of actual experiments. The author showed the horse-power curves as attaining a maximum nearly in the middle of the working limits of the pump and then drooping, so that when the head was reduced to zero, the horse-power fell considerably below the full-load value. His own experience with centrifugal pumps of the ordinary type had always shown that a decreased head increased the demand on the motor.

Mr. A. Lindsay Forster considered the continuous overhead earth wire to be an element of danger, as it might fall across the line wires, and cause serious damage. The author's comparison between electric motors and gas engines, did not make sufficient allowance for the greater cost of the gas engine repairs, which were a very considerable item.

Mr. N. B. Rosher pointed out that the cost of 0·875d. per unit for the destructor plant was decidedly high in view of the fact that steam was provided free, the load factor was 40 per cent., and interest and depreciation were taken at 8 per cent.; a not unreasonable figure to expect under the conditions which obtained would be 0·6d. From some of the load curves in the paper it would appear that a battery would be of advantage, obviating the necessity of purchasing energy from outside. As the energy was apparently taken from the public supply at ¼d. per unit, the costs of purchasing and generating were the same, although steam was provided free for generating.

Dr. Gisbert Kapp said he was connected 15 years ago with a drainage installation, where he installed seven squirrel-cage motors having 6 per cent. slip and coupled to water wheels. On receipt of a signal in the power house that water was rising in any one district, the motor in that district would be started by simply dropping the voltage of the generators which fed the motors on that side of the power house, and then switching in the required motor. He did not believe in guard wires beneath overhead lines, but preferred an electrically-operated relay at the generating station, which would operate when the electrical centre of gravity of the system had been disturbed by a broken live wire coming into contact with the earth. With regard to the statement that the horn type of lightning arrester was unsuitable for use at 6,000 volts, owing to the smallness of the gap allowing particles to lodge, a gap of 1 in. might be used on this pressure if a very thin point wire were fixed to one horn and terminated at the correct sparking distance for 6,000 volts from the other horn. On a high pressure surge occurring, it would first of all discharge across the fine wire gap, and the small arc set up would enable the main body of the surge to discharge across the wide gap, due to the decreased dielectric strength of the wide gap caused by the discharge across the narrow gap.

Some Considerations Relating to the Parallel Working of Alternators.

By the late James R. Barr, A.M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers *at Glasgow, February 14th*, 1911.)

In this paper the author discussed the various causes that lead to unstable working, and the precautions that must be taken in the design of an alternator in order that it may work satisfactorily in parallel with other sets.

Dealing first with the effect of the governor of a steam engine on the distribution of load, he explained the necessity of damping the governor to prevent hunting, and pointed out that isochronous governors were quite unsuited for engines driving alternators in parallel, as they prevented automatic distribution of the load between the machines. For this purpose a large governor drop was necessary, but this involved a large alteration in frequency between full and no load, so that the sensitiveness of the governor must be altered as the load varied—by hand if the variations were gradual, as on a lighting load, but automatically if rapid fluctuations occurred, as in power plants. He then dealt with the effect of phase displacement between the various machines in parallel due to a change in load, and explained the production and effect of synchronising currents in keeping the generators in step, showing that machines with high reactance, and therefore inferior regulating properties, were better suited for parallel working than machines designed for very close regulation.

The effects of the forced oscillations imposed upon the system by the irregular turning moment of a reciprocating engine were next considered; if the frequency of these was equal or nearly equal to that of the free oscillations, the author pointed out that resonance would occur and the machines would fall out of step. He proceeded to discuss the analysis of the torque diagram of the prime mover into the fundamental period and various harmonics, and stated that in a single-crank engine the second, in a two-crank the fourth, and in a three-crank engine the sixth harmonic would give the waves of greatest amplitude. The problem could be simplified by assuming that the curve of crank effort could be replaced by a sine curve having the same periodic time as the harmonic of greatest importance, the error caused being quite small, except in the case of certain types of gas engines, which must be dealt with by detailed analysis. The author treated the subject mathematically, showing how the maximum displacement of phase could be calculated. The synchronising torque set up by the currents flowing between the alternators tended to restore equilibrium, and he showed how this effect could be determined with the graphical construction of E. Rosenberg. The effect of damping by eddy currents was next considered, as well as the damping due to currents in the main circuit. Examples were given, worked out in detail, and the importance of predetermining the behaviour of a machine was shown, as by the proper use of dampers the weight of fly-wheel required might be greatly reduced. Experience had shown that to ensure stable conditions of working, the maximum permissible initial displacement should not exceed three electrical degrees. A low frequency was an advantage so far as parallel running was concerned, as a smaller fly-wheel could be used. Engine builders employed sufficient fly-wheel mass to limit the cyclic irregularity to $\frac{1}{100}$ in the case of single-crank engines, and to $\frac{1}{150}$ in multi-crank engines. When the E.M.F. curves of the alternators were dissimilar, there would be a resultant E.M.F. acting round the circuits between the various armatures, which might seriously interfere with parallel running, triple-frequency currents of considerable magnitude being produced when three-phase machines were run in parallel under suitable conditions.

Discussion.

Prof. Baily, who read the paper, prefaced it by a few notes on the life of the late Mr. Barr, who was only 25 at the time of his death in December last. Mr. Barr was assistant lecturer in Prof. Baily's department in the Heriot Watt College, Edinburgh. His life was a remarkably strenuous one, and his power for work was almost stupendous. Mr. Barr's physical and mental powers seemed always in harmony. Work appeared to have a stimulating effect upon his mind and body, and if he had not been taken away his life would have been one of extreme interest.

Mr. J. S. Nicolson (Glasgow University), after offering a tribute to the life and work of Mr. Barr, pointed out that the author had given an incorrect turning-moment diagram for a single-cylinder double-acting steam engine. He exhibited some curves from the Glasgow Corporation Tramways Department relating to one of their large three-crank reciprocating engines. The first curve represented the turning-moment diagram of the engine when working under abnormal conditions. The H.P. cylinder was doing approximately one half of the work. The component of the superimposed oscillating torque, which had the greatest amplitude, was the second harmonic instead of the sixth. The period of the second harmonic was $\frac{30}{75}$ sec. (the engine was running at 75 R.P.M.) The maximum rotor displacement was found to be $22{\cdot}7 \times 10^{-6}$ electrical radians (lead), and $19{\cdot}2 \times 10^{-3}$ electrical radians (lag), instead of $12{\cdot}8 \times 10^{-3}$ electrical radians as calculated from the prominent second harmonic. The assumption that "the error introduced by substituting a sine curve instead of the irregular turning-moment curve is quite small," was therefore not always justifiable. On searching for the cause of the above discrepancy in the rotor displacement, he discovered the presence in the oscillating driving torque of a first harmonic of maximum amplitude approximately $1{\cdot}0 \times 40{,}000$ lb.-ft., and of period $T_1 = \frac{30}{75}$ sec. This harmonic would give a maximum displacement of $17{\cdot}1 \times 10^{-3}$ electrical radians, a displacement much greater than that given by a more obvious second harmonic. This greater displacement was due to the greater period of the first harmonic. On plotting the two displacement curves in their proper phases, and adding them together, a maximum displacement lag or lead of $20{\cdot}0 \times 10^{-3}$ electrical radians was obtained. This displacement agreed very closely with that obtained by the more laborious method of integrating the original variable turning moment step by step. The small sixth harmonic which was present in the turning moment had no appreciable influence on the displacement of the rotor. This example showed the necessity for a careful consideration of the turning-moment diagram before any assumptions were made regarding the sine curve which might be substituted for the irregular oscillating torque. The above case should apparently have given a sixth harmonic with all the other harmonics negligible in comparison; yet the first harmonic, although not prominent, gave the greatest displacement, and the second harmonic which overshadowed all the others gave a displacement three-quarters of that of the first harmonic, and the sixth harmonic gave a displacement approximately $\frac{1}{144}$th of that of the first harmonic. The turning-moment diagram for a gas engine was given, and also a solution of the curve; but he thought it was practically impossible for anyone to obtain the correct resolution of such a curve into its harmonics. Replying to a question, Mr. Nicolson said the displacement was only 1¼ electrical degrees. The usual allowable displacement was plus and minus 3°.

Prof. Baily explained that many of the calculations were merely approximations; what they wanted to know was the point at which the engine would oscillate badly and when they were within shouting distance of that they would know how to get away from it.

Measurement of Relative Angular Displacement in Synchronous Machines.

By W. W. Firth, M.Sc.

(*Abstract of paper read before the* Institution of Electrical Engineers, *at Newcastle-on-Tyne, February 20th*, 1911.)

The author explained the cause of the mechanical displacement of the rotors of a generator and synchronous motor on load, partly due to impedance drop in the line, but mainly to armature reaction.

The actual phase displacement was measured in the case of two 5-KW. Westinghouse four-pole machines, with the apparatus shown in fig. 1.

Fixed on the half coupling on the motor shaft is a sheet-iron ring R carrying a pin-hole H. On the end of the shaft of the

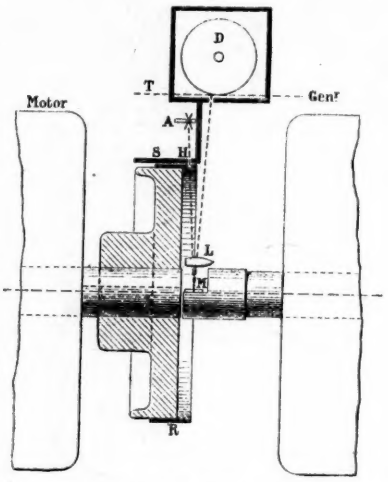


FIG. 1.—APPARATUS FOR RECORDING PHASE SWING.

generator is fixed a small mirror M with its reflecting surface in the axes of rotation; S is a fixed shield with another pin-hole on it opposite to that in the ring. The light from an arc A passes through the two holes in line once per revolution of the motor, and strikes the mirror M if the latter is suitably adjusted with reference to the synchronous position of running. Thence it passes through the fixed lens L to the tracing-screen T, or alternatively to the drum D, which carries the recording sensitive paper. When relative motion of the armatures takes place, its amount is measured by the change of position of the spot of light on the screen or drum. The spot of light is intermittent, which, when phase swing occurs, gives rise to a series of dots on the sensitive paper.

Observations of the steady displacement with change of load are plotted in fig. 2, at two constant speeds for each type of machine. It will be seen that the displacement decreases with increase of

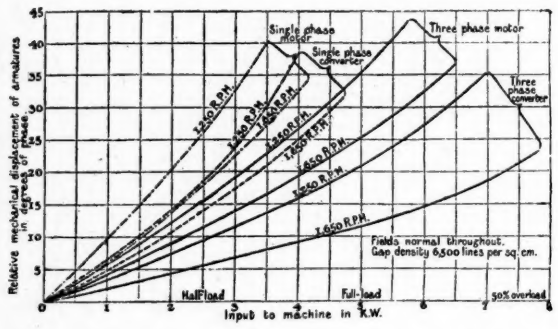


FIG. 2.—PHASE DISPLACEMENT WITH CHANGE OF LOAD AND SPEED.

speed for any given load, and that it is less in three-phase than in single-phase machines, and less again for converters than for motors, the armature reaction in converters being much smaller than in motors.

The displacements for constant loads with change of excitation were also observed, and are given in the paper. The field was usually weakened until the machine broke step, but the three-phase converter kept in step on load, even when the field circuit was opened, and when a reverse field current of about one-fifth normal value was employed, the converter slipped half a cycle and remained in synchronism. This is possible only in a converter, where the torque is small, being only that required to supply the friction and iron losses. Tests with an exploring coil and ballistic galvanometer proved that the field was strongly magnetised by the armature when the field current was zero.

A number of photographs of the phase-swinging records are also given in the paper.

DISCUSSION.

DR. THORNTON (Armstrong College) said it would be noticed that the curves in fig. 2 went in pairs, and half the difference between each pair could be looked upon as the displacement of each machine. The shift of the magnetic centre line was clearly shown, and this shift had hitherto usually been ignored. This movement resulted in the maximum voltage in a generator coil occurring somewhat later than the time arrived at by taking the back ampere-turns of the armature as equal to sin ϕ, the true back ampere-turns being 41 per cent. over the generally assumed value. Alternator characteristics predetermined by the Potier and Fischer-Hinnen methods, in which the voltage was re-assured with ϕ nearly equal to 90°, were probably in error due to phase displacement. Fig. 2 showed a greater phase displacement in single-phase machines than in three-phase machines for a given change of speed or frequency, and the fact that one got a smaller phase displacement with increase in frequency was contrary to what one would expect.

MR. W. MACCALL (Sunderland) said that by combining the curves he had found that break of step occurred with less relative displacement at light load. The application of any of the graphical methods of dealing with armature reaction—*e.g.*, Behrend's or Potier's—would show that, contrary to the general assumption, a current of unity power factor did actually weaken the field.

MESSRS. C. F. PROCTOR and P. V. HUNTER also spoke, and MR. FIRTH briefly replied.

An Electrical Fire-Damp Detector for Mines.

IN a paper read before the NEWCASTLE LOCAL SECTION OF THE INSTITUTION OF ELECTRICAL ENGINEERS on February 20th, MR. G. RALPH described and showed in operation the Holmes-Alderson fire-damp detector, of which we gave an illustrated description in our issue of October 7th, 1910. The detector is based upon the catalytic property of heated platinum, which increases the temperature in the presence of hydrogen or fire-damp; it can be set to operate with 2 per cent. of fire-damp, and can be used to actuate automatic cut-off gear, or to give audible and visible signals when the amount of gas present approaches the danger limit.

It had been suggested that the change observed in the resistance of the platinum, as used for a similar purpose in Liveing's fire-damp indicator, might in time render the Alderson detector inoperative, but this fear, the author stated, was without foundation, as the resistance of the platinum was only a small portion of the total resistance of the circuit, and any such change would, in fact, tend to render the apparatus more sensitive. The detector is capable of acting before the atmosphere surrounding it reaches a dangerous condition, and thus gives time to avert serious consequences.

Opening the discussion, PROF. STROUD asked if the apparatus would act with coal dust, and whether the contacts would be likely to be affected by it.

DR. THORNTON thought that the apparatus would be useful in certain cases, but questioned whether the design shown was robust enough for use underground.

MR. A. BARKER did not think that the apparatus would be useful in pits in which the cables did not go right up to the coal face, and also where the supply was at, say, 2,500 volts.

MR. RALPH, in reply, said that gas only could be indicated, and as the contacts consisted of two knife edges at right angles there was no chance of trouble arising from dirty contacts. The surface of platinum could easily be restored by bringing the coils to a white heat, and this could readily be done in the design shown.

The Protection of Electrical Installations in Mines.

AT the last monthly meeting of the MANCHESTER GEOLOGICAL AND MINING SOCIETY, a paper on the above subject, especially in connection with the Winhey leakage detector, was read by MR. EUSTACE E. BAKER.

The author said that, despite the objections which were put forward against the use of electricity in mines, electricity was rapidly displacing other forms of power for many purposes. The conditions under which electricity was transmitted and applied were quite special in mining work, and involved certain risks not encountered to anything like the same extent in connection with surface installations. However carefully the plant was installed and maintained, minor accidents were unavoidable. Many instruments had been devised to prevent mishaps of this description from causing any serious effects, but apparently more with the idea of protecting the plant from danger than providing any real protection against accidents to individuals and property through shock or fire.

The Winhey leakage detector had been designed to operate with such a degree of sensitiveness as to entirely isolate an installation the instant that a fault took place, and before a leakage of sufficient magnitude could be maintained long enough to cause any danger of accident through shock or fire.

In testing one of these instruments on a 550-volt A.C. system the amount of leakage current necessary to isolate the installation was found to be sufficient only to give a shock which could be appreciably felt in the nerves of the wrist and ankles—just enough to give warning of what had occurred. On again testing this instrument on the same 550-volt A.C. system, putting a live terminal into direct contact with earth, only the most minute spark could be observed before the installation was instantaneously isolated. He claimed that absolute protection was obtained by the use of this instrument under all leakage conditions. One of these instruments had been subjected to an exhaustive trial for 12 months on a colliery installation of moderate size, and during this period it had only come into operation twice through ordinary breakdown causes. With these two exceptions, it had not been found to constitute any hindrance to the working of the mine. The first stoppage occurred at a point where three single-core shaft-cables

passed along one of the underground levels. At a short distance from the shaft the cables crossed over a baulk of timber, close to a steam pipe. A joint in this pipe commenced to blow, and punctured the insulation on one of the cables, causing a small leakage to pass through the baulk to the earth. Before this leakage could cause any danger by setting the timber on fire, the detector came into operation and cut off the supply. On the second occasion the stator-winding of the induction motor went to earth, owing to a small defect which had developed in its insulation, and the instrument instantly cut off the supply before the defect could increase sufficiently to cause any further damage.

In order to ascertain whether the detector was capable of protecting life, a cage containing a rat was connected to earth, and the rat was offered a connection from one phase of a 550-volt three-phase 40-cycle system, which it bit, thus making a good connection; the detector opened the circuit, and the rat was apparently none the worse. The detector was then cut out, and the experiment repeated, with the result that the rat was instantly killed. The installation mentioned was a three-phase system, but it seemed possible to protect almost all installations in this manner, whether D.C. or A.C., earthed or unearthed, armoured or unarmoured. Direct current from a power supply company involved certain difficulties, as any leakage on the whole system would interrupt the supply, and the same amount of protection against shock could not be obtained with a high-tension system, but there was no doubt that the dangers would be materially lessened. No pilot-wires were necessary, and, in the majority of cases, the tripping-gear could be fitted to the existing circuit-breakers. The detector could be made to act as a check on those responsible for the satisfactory condition of the plant, because if it should frequently come into operation, it would be clear proof that the insulation of the whole system was generally in a bad condition, and required attention.

Mr. Robert Nelson, Inspector of Mines, wrote that the provision of safety devices of this character was clearly to be encouraged, and though he should have expected it to be too sensitive for everyday working, its record appeared to show the contrary. The new detector appeared to have given great satisfaction during a 12 months' trial. This instrument, however, seemed to have but a limited field of usefulness. It could not, he imagined, be used on any high-pressure system, or on any system in which the normal leakage current was such as would be dangerous to life. Within its limits the success of the new detector appeared to be clearly demonstrated.

Mr. G. B. Wedmore (British Thomson-Houston Co.) said there was no doubt that a large majority of accidents which had occurred could have been avoided. He suggested that armouring and earthing would have prevented by far the greater part of them, but 20 per cent. of the fatalities were due to contact with live metal; and of these one-half were due to errors of judgment on the part of individuals. A unique feature of this device was, he thought, that it eliminated the risk even where an error of judgment had been made. The speaker strongly condemned the disgraceful condition into which many electrical installations in this country had been allowed to get.

Mr. John Gerrard (H.I.M.) advocated a higher standard of maintenance; if even the best thought-out installations were handled by incompetent men, the standard of maintenance would be a low one, and it was only a question of time when accidents would follow.

Mr. Matthews (H.I.M.) supported the remarks of previous speakers as to the efficiency of the Winhey detector.

Sir Henry Hall said he thought Mr. Baker was going to benefit both the coal trade and the electrical industry, and to add very much to the safety of the people who worked in the pits. By means of that instrument they seemed to have got rid of the danger of shock and the danger of fire, two most important matters.

Mr. Sydney Smith (hon. secretary) said he had seen a gentleman that morning who was agent for a colliery in Wigan where the instrument had been in operation for the last 12 months, and he said it had given them the greatest satisfaction; although it was so sensitive an instrument, it had not lost them a single ton of coal during the whole of the time it had been installed. One of the greatest points in favour of that detector was that it showed practically the slightest leakage in any part of the installation, and it really compelled their electrical installation to be in good order.

Municipalisation in Switzerland.—Negotiations are proceeding between the Delegations of the cantons of Aargau, Zurich, Schaffhausen, St. Gall, Thurgau, Appenzell, Glarus, and Schwyz, on the one hand, and the Beznau-Loentsch power station owners on the other, with a view to the purchase of this large works by the cantons in question. In addition, the cantons of Schaffhausen and Zurich, which already possess power works of their own, have also applied to the Swiss Government to grant them a concession for the establishment of electricity works near Eglisau, and to negotiate with the Grand Duchy of Baden on the subject. As the Kabelwerk was recently created in St. Gall, and the town of Zurich has built the Albula works, it may be considered that on the purchase of the largest Swiss power works as represented by the Beznau-Loentsch station, the monopolising of electricity works by cantons and towns will have been accomplished in a large portion of Switzerland.

EVERSHED'S "DUCTER."

The Megger we know, and the Bridge-Megger we know; but what is the "Ducter"? The solution of the conundrum was revealed to us a few weeks ago, during a visit to the Acton Lane Works of Messrs. Evershed & Vignoles, Ltd.; the Ducter is, in fact, a Megger inverted, bearing much the same relation to it as a microscope does to a telescope.

The two instruments first mentioned above enable us to measure resistances quickly, from thousands of megohms down to 1 ohm; the Ducter, which is shown in fig. 1, prolongs the scale from a few ohms down to a few microhms.

The difficulties in the way of accurately measuring low resistances under workshop conditions are well known to those who have attempted the operation; it is easy in a laboratory, with elaborate apparatus permanently fixed and ready for use, but elsewhere it involves the collection and connection of a number of instruments, and can only be carried out properly by a skilled observer, with a considerable expenditure of time and trouble. With the Ducter the process is reduced to its simplest elements. A small storage cell and two pairs of flexibles are connected to the instrument, two duplex contacts are pressed against the points between which the resistance is to be measured, the position of the index on the scale is read off, and the operation is over. No calculation is required beyond the elementary one of multiplying the scale reading by 10, or a multiple of 10, according to the position of the switch. The standard range is from 10 microhms to 5 ohms, divided into five grades.

Fig. 2 shows the principle and connections of the Ducter. The movement consists of two coils, P and C, fixed upon an axle with

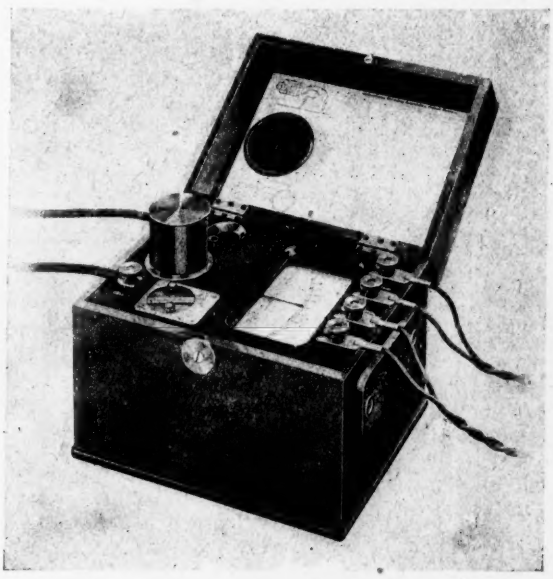


Fig. 1.—Evershed's Patent Ducter.

their magnetic axes at a certain definite angle to each other. The coil P is wound as a potential coil, and being connected in parallel with the test resistance X, it is traversed by a current proportional to the drop. The other coil C is connected across the terminals of a resistance, or shunt, in the main circuit of the battery E, and in series with the test resistance. This coil, therefore, is traversed by a current proportional to the current flowing through the test resistance, and provides a clockwise controlling torque opposed to the deflecting torque of the potential coil. The two coils move freely in the magnetic field of a powerful permanent magnet N S, and the angular position they take up depends solely upon the ratio of the current in the potential coil to that in the control coil. In other words, the deflection of the movable system depends solely upon the ratio of the drop across the test resistance to the current flowing in it; that is to say, it is a measure of the resistance X.

The index is attached to the upper end of the movement axle, and ranges over a scale of microhms which is visible through a window in the terminal board of the instrument.

The movable coils are connected to their fixed terminals by means of three flexible metal spirals and one flexible metallic suspension, which serves the double purpose of a connection to one end of the control coil, and a means for supporting the weight of the movable system, and so relieving the jewelled step bearing from pressure In fig. 2 these flexible connections are indicated by dotted lines.

The five-way switch for changing the sensibility has three poles —A, B and M. Of these poles A varies the resistance in the circuit of the potential coil according to the grade; pole M connects the battery to the proper shunt for the grade, and at the same time inserts such resistance as may be necessary to reduce the battery current to a convenient working value; and the third, pole B, connects the control coil through a series resistance to the particular shunt which is in use. In the actual switch the three contact arms A, B and M are attached to a common axle, round which the studs

belonging to the three poles are arranged in a ring. The switch is fixed under the dial of the instrument and connected to an external handle by means of parallel connecting rods. The switch arms are pivoted levers fitted with laminated copper rubbing contacts working over wrought copper studs, the contact pressure being provided by spiral springs which act independently on each lever. The instrument has six terminals, namely, two for the battery marked + and −, two for the main current marked T T, and two potential terminals V V.

It will be readily seen that if the subject under test happens to be of high resistance, or to contain an open circuit, the full voltage of the storage battery may inadvertently be applied to the potential coil; in fact, this is certain to happen more or less frequently, and the consequences to the coil would be disastrous—were it not for the device shown at K on the diagram, fig. 2; this is a cut-out, probably the smallest "automatic circuit-breaker" in existence. It depends upon polarised magnets for its operation, and the inertia of the moving parts is so small that the cut-out opens the circuit before the coil receives a violent impulse from the excessive current. Two movable contact arms are provided, one for each direction of the current, and they are visible through a window in the terminal board; the cut-out is reset by pressing a knob close to the window.

The Ducter is compensated for temperature, and gives the actual resistance of the thing tested at the moment of the test; in fig. 2 it is shown measuring the resistance of a metal strip X, between the points G and H, which will be seen to be 8,500 microhms. The contacts are shown in fig. 3; the potential spikes are covered with sleeves, and are applied between the current contacts. The spikes are of ingenious design; they are all independently pushed outwards by springs, and are provided with archimedean screws on the inner ends, which cause them to rotate when pressed inwards. As the points are pyramidal, the rotary motion ensures good contact even on a dirty surface, and the springs compensate for irregularities of the surface.

In most cases, with the aid of these duplex contacts, one man can perform the whole test; but as it may be more convenient sometimes to use the potential spikes separately, as when measuring a number of resistances connected in series, a pair of single

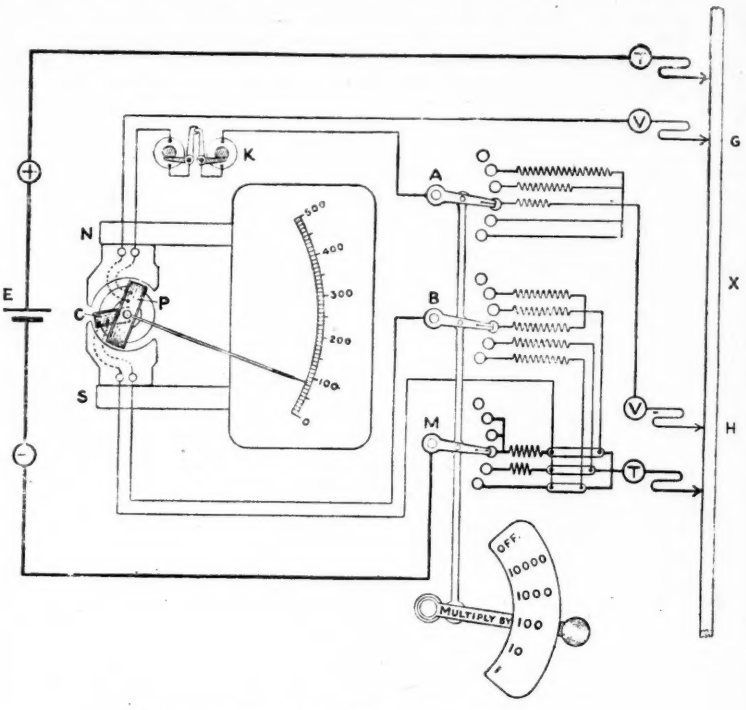


FIG. 2.—DIAGRAM OF CONNECTIONS OF THE DUCTER.

E, Battery; C, Current coil; P, Potential coil; N, S, Poles of magnet; K, Cut-out; A, B, M, Triple-pole grade switch; X, Resistance under test; H, G, Potential contacts.

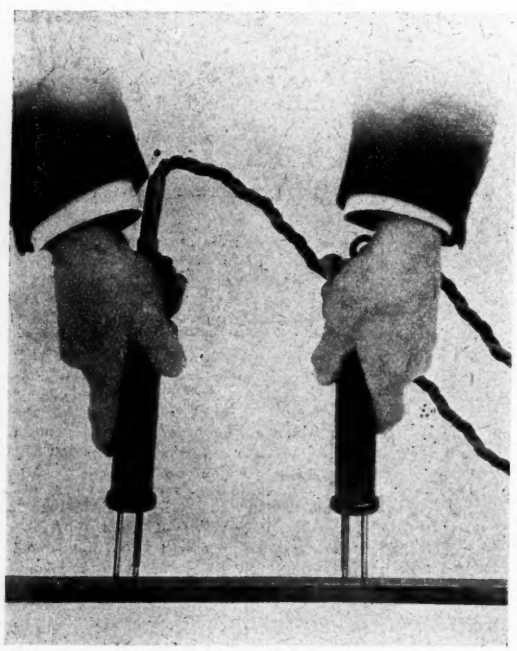


FIG. 3.—THE DUPLEX CONTACTS IN USE.
(The potential spikes are those with sleeves.)

spikes is provided for the purpose. The battery consists of four cells in a teak case, with a switch which couples them in parallel or series, the latter connection being used only for resistances above one ohm. The cells are of the Lithanode unspillable type in celluloid boxes, and have a capacity of 10 ampere-hours each.

It is hardly necessary to point out the many uses to which the Ducter can be put; it fills a gap in the range of measuring instruments which no one has hitherto attempted to bridge. For testing joints, switchgear, fuses, and conductors of all kinds, the Ducter is a most handy and convenient instrument, and we have no doubt that it will take an honoured place with its two forerunners in the works test room.

PARLIAMENTARY.

Winchester Corporation (Electric Light) Bill.

A SELECT Committee of the House of Lords, under the chairmanship of Lord Southwark, considered on Thursday, Friday and Monday the Bill promoted by the Winchester Corporation for the acquisition of the undertaking of the Winchester Electric Light and Power Co., Ltd. Mr. Balfour Browne, K.C., and Mr. Keene appeared for the promoters, and Mr. H. Lloyd and Mr. Paddon represented the water and gas company, who opposed.

MR. BALFOUR BROWNE, in opening the case, said the Corporation obtained an Electric Lighting Provisional Order in 1895, so that the opposition of the gas company now was rather belated. The agreement with the Winchester Electric Light and Power Co. was dated 1897, and under that agreement the Council transferred its powers to the company for a period of 42 years, with a saving clause, however, giving them the right to buy the company out. If the Corporation purchased within seven years the price was to be the amount of the capital which had been reasonably expended, plus 15 per cent. If, within 14 years, it was to be the amount reasonably expended, plus 10 per cent., and if within 21 years the amount spent, plus 5 per cent. The notice to purchase was given by the Corporation within the second period, and they were, therefore, to pay 10 per cent. extra. The Corporation appointed Mr. C. H. Merz as their electrical adviser to enter into negotiations with the company and so prevent the expense of arbitration. The company asked for £99,732 as the amount which had been reasonably expended, and ultimately the engineers arrived at the conclusion that the undertaking, measured in this way, was worth £91,000. Had the matter gone to arbitration, two serious questions might have been raised. In the first place the company had laid mains outside the city and where they had no right to supply, and the Corporation would not be bound to purchase that part of the undertaking. It was, therefore, necessary to have an Act of Parliament to authorise the Corporation to purchase the whole of the undertaking. The electric light company had also done a considerable amount of free-wiring, and it was open to question whether the Corporation had the right to buy that as part of the undertaking without an Act of Parliament. The company had expended about £15,000 on free-wiring. [The Corporation considered they had a very good bargain, for they could borrow the money for the purchase at 3½ per cent., and after providing for interest and sinking fund, the present net income of

the company would leave a surplus of £2,500 a year. The Corporation, however, expected to increase the income, and asked to supply an area outside the city, where a large number of good houses were being erected. Winchester was an isolated city, and unless the Corporation supplied the want, no-one else would. Counsel proceeded to deal with the petition of the gas company, who strongly objected to the Corporation supplying electricity outside the city, and said that the petitioners simply objected to competition.

Mr. C. H. Merz said he was retained as consulting engineer to the Corporation. He had personally inspected the company's plant, and found it in good order, and except in a few minor details, suitable for the needs of Winchester, and also sufficient in capacity to deal with more than the present load. He considered that the settlement arrived at between the Corporation and the company was very desirable, and that the Corporation saved probably £15,000 by not going to arbitration. He did not see how anyone could regard the probability of a loss regarding the purchase.

In cross-examination, Witness said the Corporation got the undertaking for an agreed sum, and had nothing to do with depreciation. The mains had been examined as far as possible, and their condition and the manner in which they were laid were satisfactory. He thought the cables might be there another 40 years, but there was no evidence that he could go upon.

Councillor Furley (Mayor of Winchester) gave evidence in support of counsel's opening statement. In cross-examination, he said he was not aware that the Corporation were advised that if they went to the Local Government Board or the Board of Trade, they would not get more than 20 years for the repayment of the loan. They wanted the best terms they could get, and, of course, a longer period for repayment was an advantage to the town.

Several members of the Town Council and the Town Clerk having been called,

Mr. C. P. Sparks, engineer of the County of London Electric Supply Co., said he visited the works at the instance of the Corporation, and considered that the present plant was capable of producing 25 per cent. more than the present load. The plant was in excellent condition. If he were called in to advise a Corporation starting an electricity undertaking, he should recommend them what the Winchester Corporation were now getting. He considered that in acquiring the undertaking for £91,000 the Corporation had a good bargain.

In cross-examination, Witness said the total capital expended on the undertaking was £90,000, but he did not know what the share capital was. He considered that if that period for the repayment of loan was cut down, it would be unfair to the present ratepayers.

In re-examination, Witness said the mains were not faulty, and there was no reason to suggest that the cables would not last for another 50 years.

Mr. F. E. Gripper, chairman of the Winchester Electric Light Co., said that if the Corporation had taken over the company as a going concern, they would have had to pay £30,000 or £40,000 more. The company were sorry to part with the concern, for it was an extremely good one.

In cross-examination, Witness said the Corporation were buying not only the plant but the works and buildings and goodwill, and these, if bought as a going concern, would fetch a great deal more than the £91,000.

Mr. W. R. Keen, chartered accountant, said the company was a progressive one. The net revenue started at £2,000, and was now over £6,000.

The case for the promoters having closed, Mr. J. C. Warner, chairman of the Winchester Gas Co., was called, and gave particulars of the class of houses outside the city. He doubted if it would pay to supply electricity in the district. He objected to commercial competition with the rates behind one party.

Mr. J. F. Snell, of the firm of Preece, Cardew & Snell, engineers, Westminster, said he had gone into the details of the accounts of the Winchester Electric Light Co., and he saw that some of the machinery was working 12 or 13 years ago. Roughly speaking, he would say that one-third was original plant, but he had not seen it, as the town clerk refused an application of inspection.

Mr. Balfour Browne said that the matter was not then in the hands of the Corporation, and all the town clerk said was that he had no power to give permission.

Witness, continuing, said that according to an engineering estimate the present number of 515,000 units could not be increased to more than 650,000 units at the most. He thought the Corporation would have been better advised to have waited until the end of the whole period, and then have bought on ordinary terms. Instead of the Corporation reaping a handsome profit, he estimated that they would find during the first year they would have to meet a loss of £3,024, if they made the necessary provision for past depreciation and the output was maintained.

Mr. Paddon, addressing the Committee on behalf of the gas company, said that if the Bill was rejected his company would still remain in competition with the electric light company, and therefore it was not the fear of competition which brought them there. Their chief objection was that this was a bad bargain which the local authority was entering into, because the proposed price was obviously excessive. It was proposed to pay every farthing of the capital expenditure; and when they considered that a third of the plant was 13 years old, and by far the larger portion of the plant seven years old, then he contended it was absurd to suggest to any business man that the plant was worth the money it cost. Whatever replacements and renewals may have been carried out, the plant must depreciate in value by becoming obsolete. The capital expenditure, roughly speaking, on the undertaking had been £85,000, and he submitted that no depreciation had been written off this. Their second objection was that the period of 40 years for the repayment of the loan was far too long, and this was pointed out in the report of the Local Government Board. Further, the promoters asked for £20,000 of working capital, and had not submitted any detailed estimate of what it was required for, which was against the practice of Parliament. If the Committee passed the preamble, he urged strongly that the Northumberland Clause should be inserted, which would provide for a revision of the prices charged every three years if the concern made a loss. In 1904 that clause was inserted in 24 Bills, and had been frequently inserted in Bills since.

Mr. Tinsley Jones, interposing on behalf of the Winchester Electric Light and Power Co., said the company had had the undertaking for a certain number of years, and the terms of the transfer deed bound them to sell again to the Corporation. This deed was approved by the Board of Trade, and under it notice had been served on the company, and, in the ordinary way an arbitration would follow. Pending the arbitration, however, an agreement was come to with the object of avoiding the expenses of arbitration. If the Bill was rejected, it simply meant that the matter would go to arbitration, and then the company's claim would be for £99,000, and he thought they would be able to establish that claim before the arbitrator.

Mr. Balfour Browne said the Corporation were bound to purchase, for they had given notice, and if the matter went before an arbitrator, he would be bound to admit that capital to the extent of £90,000 had been reasonably expended, and the Corporation would have to pay that, plus 10 per cent. The deed of transfer simply said that the arbitrator was to ascertain if the capital had been reasonably expended and if the works had been properly maintained, and consequently the criticism of the Local Government Board was beside the mark altogether. The transfer deed was approved by the Board of Trade, and the Corporation were bound by it. Counsel proceeded to urge that 40 years should be allowed for the repayment of loan, although, so far as the £20,000 asked for for working capital, he was agreeable that the term of repayment should be 30 years.

After private consultation, the Committee allowed the Bill to proceed, and granted 40 years for the repayment of the loan for the purchase of the undertaking and 20 years for the repayment of the £20,000 new capital. They also decided to insert the Northumberland clause.

Brighton District Tramways.

Before the Standing Orders Committee of the House of Lords last week an application was made by Mr. Kennedy, on behalf of the promoters of the Brighton District Tramways Bill, to dispense with the standing orders relating to the consents of the road authorities.

Mr. Kennedy explained that the scheme in the Bill was to construct a continuous line of tramway between Brighton and Worthing, the length being about 10½ miles. The consents of six road authorities had been obtained, viz., those of Steyning West, Shoreham, Southwick, Portslade, and the East and West Sussex County Councils. The consents of Hove, Worthing and Brighton had been refused. The Worthing Corporation obtained powers to construct tramways themselves in 1903, but had not exercised the powers. A petition signed by 2,861 owners and occupiers of Worthing had been received in support of the Bill, and if the Committee dispensed with the consent of that Corporation it would give him the consents of the local authorities over two-thirds of the route which was necessary to bring him within Standing Order 22. At present he was a few yards short.

Replying to Lord Balfour, Mr. Kennedy said he had an arrangement by which, if the Bill passed, the promoters became possessed of the existing horse tramway in Hove.

Mr. Bonner Maurice strongly opposed the application on behalf of the Hove Corporation, and said that the Corporations of Hove, Worthing and Brighton were unanimous in the view that tramways were not needed in these districts. It was true that some years ago the Hove Corporation promoted a scheme of tramways, but they did not proceed with the Bill as they found it was against the wishes of the inhabitants.

Mr. Pritchard, on behalf of the Worthing Corporation, explained that the reason why they obtained powers to construct tramways was because they were threatened with tramways from Brighton to Worthing by the British Electric Traction Co., and being under the impression that they could not successfully defeat that Bill, they thought if tramways were to come they should have complete control over the construction. The Corporation objected to tramways as they considered they would be injurious to the borough.

The Committee refused to dispense with the standing orders.

Carbons for Searchlights.—Mr. Paget asked the First Lord of the Admiralty if he would state from what country or countries supplies were obtained of the carbons required for searchlights and other electric lights in the Navy and naval dockyards; if such supplies came from abroad; whether tenders were invited from British firms, and, if so invited, on what grounds they were rejected. Mr. McKenna replied that the carbons were obtained from manufacturers in England. It had sometimes been necessary to obtain from foreign makers small quantities required for certain special lamps, for which British manufacturers had not yet succeeded in producing entirely suitable carbons, but this was not expected to be necessary in future. In any such case, it had been customary to invite tenders from the British agents of the foreign

manufacturers. No tender for British-made carbons had been rejected where suitable quality was obtainable.

Post Office Engineers.—Mr. Hudson asked why it had been found necessary to advertise for Post Office engineers in view of the number of sub-engineers qualified for this position in January, 1910, who were recently informed that there were no vacancies at present; whether it was intended to promote the existing fully qualified engineers before appointing the outside applicants: and whether it was the Postmaster's intention to subject these applicants to a competitive examination similar to that imposed in the case of candidates nominated from universities and colleges. Mr. H. Samuel replied that it was not necessary permanently to increase the authorised complement of engineers, and such additional men as were to be sought from outside sources were required to meet a special and temporary need in connection with the telephone transfer. All the sub-engineers referred to had already been allocated to this or equivalent work, but their number was not sufficient. The temporary engineers having no prospect of continued employment, there was no need to subject them to the educational and technical tests applied to candidates seeking established posts with ultimate prospects of promotion to higher positions.

Second and Third Readings.—In the House of Lords on March 27th, the Brighton District Tramways Bill and the Southampton Corporation Tramways Bill were read a second time.

In the House of Commons on Monday, the London County Council (Tramways and Improvements) Bill was read a second time.

In the House of Commons on March 24th, the London Electric Railway Bill and the Metropolitan District Railway Bill were read a third time.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

AMENDMENTS.

SOUTH AFRICA.—The Customs authorities have published a decision to the effect that "Colvin Electric Compo" being a dressing for commutators, is to be dutiable at the rate of 12 per cent. *ad valorem* under the British Preferential Tariff.

VENEZUELA.—A Presidential decree of December 29th, 1910, provides for an additional 1 per cent. on the total import duties (including territorial and war taxes) to be levied on all goods entering Venezuela; the decree was to come into force on January 1st last, and is to remain in operation until some new arrangement is arrived at.

NYASALAND.—The Government has published a notification providing for new schedules of the Consolidation Customs Ordinance. The list of articles which may be imported into the Protectorate free of duty has been extended to include goods for the use of the Government, agricultural and industrial machinery, materials for railways and tramways, and materials for telegraphs. Goods not specially mentioned in the tariff—*i.e.*, most goods with the exception of liquors and scents—are dutiable at the rate of 10 per cent. *ad valorem*, calculated on the value of the goods as they lie at the port of shipment, exclusive of trade discounts and of freight, insurance and other charges.

NEW ZEALAND.—The Customs Authorities have issued the following decisions regarding the duties to be levied on certain goods: electric appliances:

Cut-outs, automatic for dynamos—
If imported attached to the dynamos ... 10 % *ad valorem.*
If imported unattached to the dynamos 20 % *ad valorem.*

The rates quoted are those for British goods under the Preferential Tariff.

PANAMA.—The Customs Authorities have decided to raise the rate of duty leviable on various goods from 10 per cent. *ad valorem* to 12½ per cent. *ad valorem*; this decision will have the effect of raising the duties on electrical goods and similar articles.

NEW PATENTS APPLIED FOR, 1911.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

6,203. "Regulating time-limit liquid controller for electric motors." F. C. MORRIS. March 13th.

6,257. "Apparatus for generating electricity on motor-driven vehicles and he like." H. F. JOEL, JUN., and J. TAYLOR. March 13th.

6,272. "Automatic electric valves more particularly for use in conjunction with gas lighting." R. HACKING. March 13th.

6,293. "Electric control systems." ALLGEMEINE ELEKTRICITATS-GES. (Convention date, March 12th, 1910, Germany.) March 13th. (Complete.)

6,336. "Alternating-current arc lamps." KORTING & MATHIESEN AKT.-GES. Convention date, March 30th, 1910, Germany.) March 14th. (Complete.)

6,345. "Portable telephones." W. FAIRWEATHER. (S. Stein, United States.) March 14th. (Complete.)

6,373. "Variable speed transmission for petrol-electric vehicles and for other purposes." W. A. STEVENS. March 14th.

6,374. "Electric heaters or connectors." J. E. POWNALL. March 14th.

6,401. "Apparatus for regulating, or maintaining constant, the electromotive force or current in circuits in connection with electric generators or boosters." W. H. SCOTT. March 14th.

6,460. "Manufacture of metal tube, particularly of use as an electrical conduit." J. EVANS. March 15th.

6,515. "Electric lighting." S. A. EDWARDS. March 15th.

6,531. "Sparking plugs." W. MORGAN and E. BADDELEY WOOD. March 15th.

6,545. "Electric accumulators." G. FULLER, L. FULLER and G. J. A. FULLER. March 15th.

6,549. "Multiple telephony." E. RUHMER. (Convention date, March 16th, 1910, Belgium.) March 15th. (Complete.)

6,557. "Control of electric motors." ALLGEMEINE ELEKTRICITATS GES. (Convention date, March 15th, 1910, Belgium.) March 16th. (Complete.)

6,577. "Arc lamps." H. C. BLACKWELL. March 15th.

6,611. "Variable-speed dynamos, such as those employed for train lighting." ELECTRIC & ORDNANCE ACCESSORIES CO., LTD., J. ETCHELLS and E. W. PRICE. March 16th.

6,616. "Electric fuseholders." W. K. L. DICKSON. March 16th.

6,626. "Electric order signalling apparatus." SIEMENS BROS. & Co., LTD. (Siemens & Halske A.G., Germany.)] (Addition to No. 19,684/09.) March 16th. (Complete.)

6,627. "Electric block-signalling systems." SIEMENS BROS. & Co., LTD. (Siemens & Halske Akt.-Ges., Germany.) March 16th. (Complete.)

6,647. "Electric hammer." F. W. WHITE and A. STEWART. March 16th.

6,650. "Combined electric hair comb and brush pad." W. H. CADMAN. March 16th.

6,663. "Control of electrically-operated switches." BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., U.S.) March 16th.

6,664. "Electric elements." ELEKTRICITATS AKT. - GES. HYDRAWERK. (Convention date June 23rd, 1910, Germany.) March 16th. (Complete.)

6,682. "Production of electrical oscillations by direct current." W. P. THOMPSON. (Ges. für Drahtlose Telegraphie m.b.H., Germany.) March 17th. (Complete.)

6,695. "Electrically-driven coal-cutting machines." ANDERSON, BOYCE AND CO., LTD., and A. ANDERSON. March 17th.

6,723. "Electric incandescent lamps." A. MILNE. March 17th.

6,736. "Means for fixing and insulating contact springs for electrical apparatus." SIEMENS BROS. & Co., LTD., and C. R. RIBER. March 17th. (Complete.)

6,737. "Means for fixing and insulating contact springs for electrical apparatus." SIEMENS BROS. & Co., LTD., and C. R. RIBER. March 17th. (Complete.)

6,783. "Alternating-current arc lamps." KORTING & MATHIESEN. (Convention date March 29th, 1910, Germany.) March 18th. (Complete.)

6,856. "Incandescent arc lamps." J. T. ROBIN. March 18th.

6,861. "Electrical switch or controlling device." G. WALLACE and J. E. GRAHAM. March 18th. (Complete.)

6,862. "Electrical time switch." G. WALLACE and J. E. GRAHAM. March 18th. (Complete.)

6,863. "Electrical signs, advertising devices, and the like." G. WALLACE and J. E. GRAHAM. March 18th. (Complete.)

6,869. "Equipment for use in submerged electrical communication." J. HUDSON-DAVIES. March 18th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1909.

SOCKETS FOR ELECTRIC CABLES. Lebedenko. 30,491. (June 18th, 1910.)

1910.

ELECTRIC METERS. A. Stromberg and G. M. Willis. 4,273. February 21st.

ELECTRICAL ACCUMULATORS. F. W. Hardy and E. H. Hungerbuhler. 4,320. February 21st.

ELECTRICAL LAMPS AND OTHER GOODS HAVING LEADING-IN WIRES SEALED THROUGH THEM. B. E. Eldred. 4,467. February 23rd.

EMPLOYMENT OF METALS IN THE ELECTRIC ARC FOR THE STERILISATION OF LIQUIDS. E. Urrain, A. Feige and C. Scal. 4,796. February 25th. (January 17th, 1910.)

INSULATING CONDUITS FOR ELECTRIC WIRES OR CONDUCTORS. A. R. Hinsky. 5,048. February 28th.

ELECTRICAL SWITCHES AND THE LIKE. D. K. Morris and G. A. Lister. 5,221. March 2nd. (Addition to No. 21,938 of 1907.)

AUTOMATIC MAKE-AND-BREAK CONTACT DEVICES FOR ELECTRIC CIRCUITS. E. A. Bridge. 6,719. March 17th.

ELECTRIC INCANDESCENT LAMPHOLDERS. W. G. Collins. 8,913. April 13th.

MEANS FOR STARTING AND CONTROLLING ELECTRIC MOTORS. Adams Mfg. Co. (Cutler-Hammer Mfg. Co.) 9,101. April 11th.

HOLDERS OR FITTINGS FOR ELECTRIC INCANDESCENT LAMPS. A. Lobel and British Ever-Ready Electrical Co. 11,051. May 4th.

LEADING-IN CONDUCTORS FOR ELECTRIC LAMPS AND OTHER SIMILAR DEVICES. British Thomson-Houston Co. (General Electric Co.) 13,295. June 1st.

MOTOR CONTROLLER CIRCUITS. Adams Mfg Co. (Cutler-Hammer Mfg. Co.) 17,340. July 21st.

ARRANGEMENT FOR PRODUCING BUT SLIGHTLY DAMPED ELECTRICAL OSCILLATIONS BY THE SHOCK EXCITATION METHOD. E. C. Dymond. (Ges. für Drahtlose Telegraphie.) 18,545. August 5th.

ELECTROMAGNETIC CLUTCHES. R. Miram and L. Seidel. 19,952. August 26th. (July 25th, 1910. Addition to No. 19,786 of 1910.)

SOUND-MAGNIFYING DEVICES FOR TELEPHONES, ALSO APPLICABLE FOR USE WITH TALKING MACHINES. A. E. Lamkin and P. C. Pace. 20,399. September 1st.

CIRCUIT-BREAKING APPARATUS FOR USE IN PRODUCING IGNITION IN EXPLOSION MOTORS. Soc. d'Electricité Nilmelior. 20,863. September 7th. (March 2nd, 1910.)

ROTARY FIELD ELECTRIC TRANSFORMERS. Siemens Bros. Dynamo Works. (Siemens-Schuckertwerke Ges.) 21,583. September 16th.

THERMO-ELECTRIC CIRCUITS. Cambridge Scientific Instrument Co. and H. Darwin. 24,668. October 24th.